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DIGGING NEW YORK'S CITY-OWNED SUBWAY

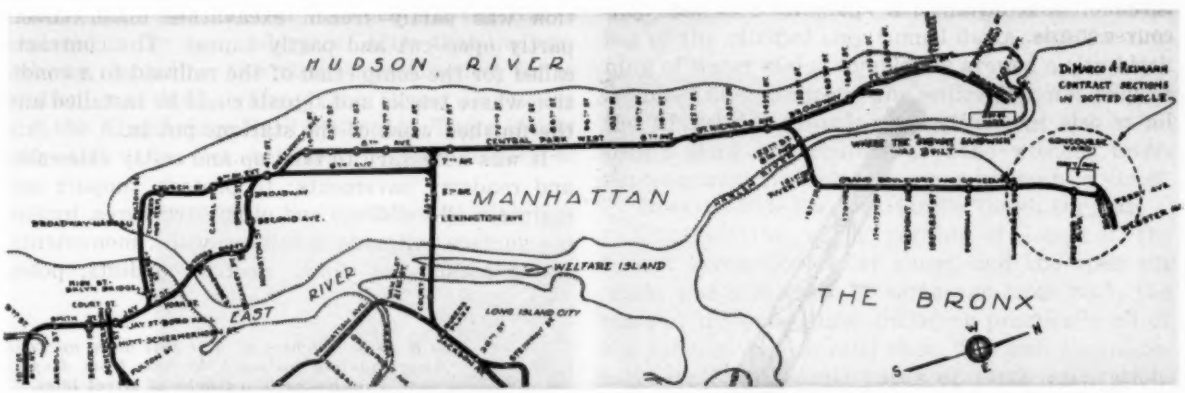
DiMarco and Reimann construct a "SUBWAY Sandwich"

By Spencer A. Jones

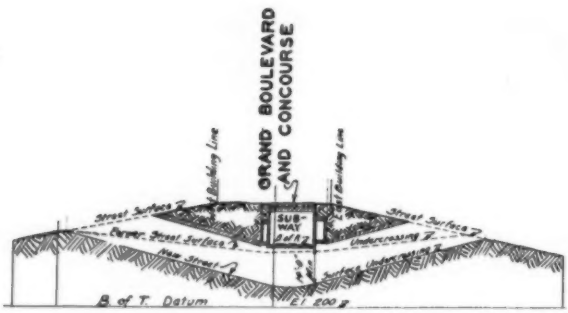
NEW YORK'S new $676,460,000 city-owned rapid transit railroad, called the "Independent System", is an entire system of lines, independent of other railroads, which radiates from the Borough of Manhattan along important streets and avenues to the Bronx, Brooklyn and Queens. Construction and equipment of the Independent System is under way in the four boroughs, and it is estimated that the parts now authorized will be completed by the end of 1937.

In the issuance of contracts for construction and equipment, the program has been arranged to complete operable units as rapidly as possible so that passenger service may be instituted on parts of the railroad before the whole project is completed. The first of these units, now completed and equipped, extends from Fulton Street in downtown Manhattan to West 207th Street, nearly 12½ miles uptown.

The second of these units, at present nearing completion, connects with the first unit at 149th Street and St. Nicholas Avenue, runs under the Harlem River to the Grand Concourse, follows under the Grand Concourse and finally branches off to the northeast, ending at East 205th Street and Webster Avenue in the Bronx. It is estimated that this second unit, known as the Grand Coucourse line, will be ready for operation about January 1st, 1933.



Above: Map showing location of DiMarco & Reimann contract. At right: Bucyrus-Erie Type AA air-driven tunnel shovel loading out rock at the Mosholu Parkway North—at portal cut.



PROFILE ALONG KINGSBRIDGE ROAD
LOOKING NORTH AT THE "SUBWAY SANDWICH"

DiMarco & Reimann Build Two Sections of Second Unit

This article deals with the construction of the two most northerly sections of the Grand Concourse line, contracts for which were let by the city to DiMarco & Reimann of New York. The first contract was for Section No. 6, which extends under the Grand Concourse from East Kingsbridge Road to Van Cortlandt Avenue. The second contract was for Section No. 7, the adjoining and most northerly section, extending from Van Cortlandt Avenue north under the Grand Concourse, crossing under Mosholu Parkway, private property and intersecting streets, and under and along East 205th Street to Webster Avenue. It includes, also, a branch extending westerly under and along Van Cortlandt Avenue from East Mosholu Parkway South to Villa Avenue. This latter is a spur track to the Concourse yards.

What the Figures Were

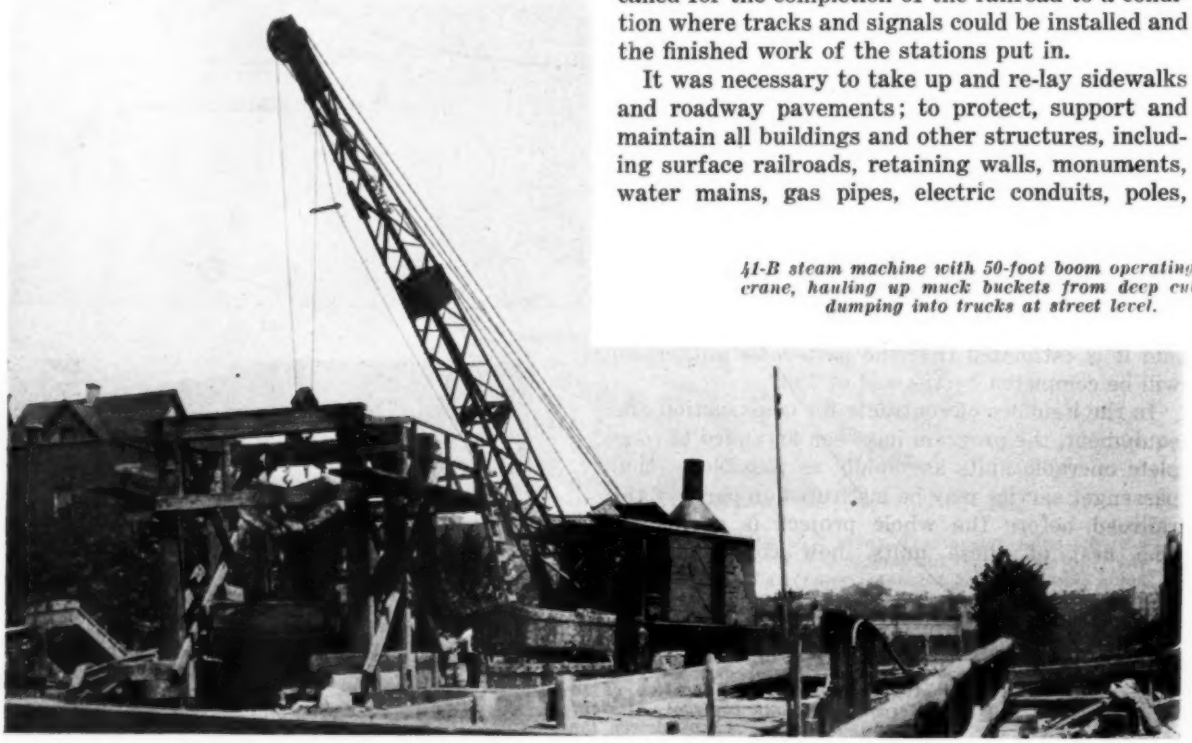
The contract price on Section No. 6 was $6,701,232.50, and on Section No. 7 it was $2,694,038.00. Unit prices on Section No. 7 are given herewith:

Classification of Work	*Unit Price*	*Estimated Quantity*
Earth Excavation (except tunnels), including disposal as backfill in railroad	$ 4.50	85,800 cu. yds.
Rock Excavation (except tunnels), including disposal as backfill in railroad	4.50	72,500 " "
Tunnel Excavation, including disposal as backfill in railroad	11.00	27,400 " "
Disposal of Earth not required for backfill in railroad—hauled 4 miles	.50	17,000 " "
Disposal of Rock, same as above	.70	99,900 " "
Concrete Masonry in place	18.00	28,500 " "
Finished surfaces of concrete	.10 yd.	89,000 sq. yds.
Portland Cement Grout	7.00 bbl.	2,400 bbls.
Riveted Steel, beams and shapes, painted and erected	98.00 ton	4,350 tons
3-Ply Waterproofing of Treated Woven Fabric, laid in asphalt	1.75 yd.	16,800 yds.
Vitrified Clay Tunnel Ducts, in place	.25 ft.	91,000 lin. ft.
Maintaining, protecting and securing 29 buildings	$187,000	
Taking down and disposing of 11 buildings	59,000	

The General Scope of the Contracts

The work done included the care and support of surface, sub-surface and overhead structures; the maintenance of traffic and the restoration of street and park surfaces. The general method of construction was partly trench excavation under cover, partly open cut and partly tunnel. The contracts called for the completion of the railroad to a condition where tracks and signals could be installed and the finished work of the stations put in.

It was necessary to take up and re-lay sidewalks and roadway pavements; to protect, support and maintain all buildings and other structures, including surface railroads, retaining walls, monuments, water mains, gas pipes, electric conduits, poles,



41-B steam machine with 50-foot boom operating as crane, hauling up muck buckets from deep cut and dumping into trucks at street level.

wires and vaults; to remove certain buildings in private property; to build sewers, and look after all the thousand and one other odds and ends that crop up when a subway is built in New York.

Work was started on the first of the contracts, Section No. 6, in August, 1929; and on the second contract, Section No. 7, in January, 1931.

Making a "Subway Sandwich"

One of the outstanding features of DiMarco & Reimann's work was the successful construction of what might be called a "subway sandwich" at the intersection of the Grand Concourse and Kingsbridge Road. Here the new subway, running along underneath the Grand Concourse, met Kingsbridge Road underpass, which carries 2 trolley tracks and which was only about 20 feet below the level of the Grand Concourse. At other underpasses it was possible to run the subway beneath the underpass, but at Kingsbridge Road this was impracticable because of the steep grade it would impose on the subway. It was decided to lower Kingsbridge Road where is passed under the Grand Concourse, and run the new subway between the two highways.

First it was necessary to take up the trolley tracks from Kingsbridge Road and run them up over the Grand Concourse on wooden decking which covered the intersection, making a temporary grade crossing. Then Kingsbridge Road was cut down 13 feet to the required level and the supporting steel and concrete installed and the tracks replaced in the new underpass. After that the new subway, including the rough construction for a station, was built between the Grand Concourse and the Kingsbridge Road underpass. There is now only 4 ft. 0 in., net, between the road surface of the Grand Concourse and the underside of the ceiling beams of the new subway.

Top: Noon hour for a 41-B between Bainbridge and Perry Avenues. The subway is shown in open cut and continues as a tunnel through the rock cliff in the center background, running under the occupied buildings shown on the hill above. Lower: Grand Concourse, looking north from Kingsbridge Road.

Among the problems connected with this "subway sandwich" was the flattening out and widening of the vitrified clay tunnel ducts, and the running of water mains completely around a city block to miss the underpass. The entire job, not only at the Kingsbridge Road intersection, but also at all points along the route, was done without interrupting traffic, which is quite a triumph in itself.

his tough little aby is taking a st under 200th treet while the ngineer grabs off little lunch. Note he 10"x10" deck-ng on the tempo-ary crossover. he timbering in ft foreground is 12"x12" Douglas fir.

Bucyrus-Erie Shovels Handle Tough Digging

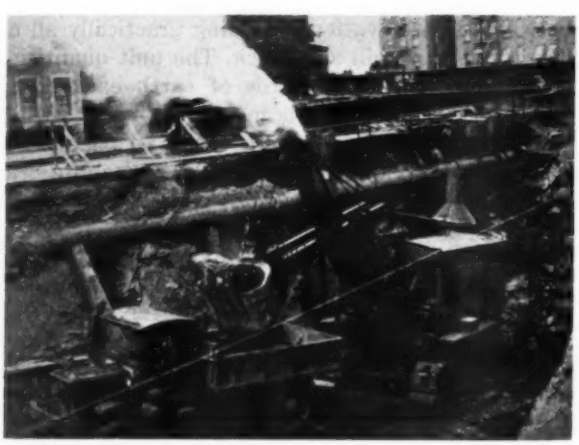
Although the upper portion of some of the trench excavation under cover, and the open cut work, was a mixture of earth and loose rock, the most of the excavation, including practically all of the tunnels, was in solid rock. The unit quantities estimate 85,800 cubic yards of earth excavation, but earth in New York is mostly big rocks with a little sand and clay between them, as a glance at the photographs will show. 40% dynamite was used as a blasting material, and the earth and rock from shallow trench excavations was loaded by 4 Bucyrus-Erie 41-B shovels into dump trucks and hauled out. In the deep cuts, the shovels loaded into buckets which were hoisted to the surface by 41-B's equipped with 50-foot cranes and dumped into trucks at street level. The 41-B shovels were operated with both steam and compressed air depending on the type of trench. When operating with steam, coke was used as fuel. Earth and rock, not required for backfill, was hauled about 4 miles and dumped in Pelham Bay Park.

Just going for a little swim, that's all. This 41-B was in the hole when the rain came, but went to work the next day. No damage done.

Tunnel Shovels Also Used

The rock from the tunnel excavations was easily and quickly handled by 2 Bucyrus-Erie Type AA tunnel shovels, operating on 80 lbs. compressed air. Motor trucks hauled out the tunnel rock on Section No. 6, and Hughes Keenan Iron Mules, with 2 cu. yds. capacity, hauled the tunnel muck away from the shovels on Section No. 7, dumping the rock into buckets which were hoisted to the surface by the 50-foot booms on 41-B's, and emptied into motor trucks.

The round tunnels were excavated at the rate of 125 lineal feet per week each, working two 8-hour shifts per day on a 6-day week. The "payment" rock diameter in round tunnels was 20′-3″, and the finished inside diameter of the concrete lining was 16′-9″. The tunnels were of various shapes, depending on whether they ran through solid rock, earth and rock, or had to be widened out for stations, etc. Square tunnels had the center hole dug out first, and the supporting steel set, then the bore was widened at either side and the sidewall and roof steel and the concrete lining were installed.



41-B Bucyrus-Erie coke-fired shovel digging in "earth" at 200th street and the Grand Concourse. Note water main partly shored and partly suspended.

How the Concrete Lining Was Poured

A Ransome Horizontal Pneumatic Concrete Placer was used in lining sidewalls and ceilings of tunnel portions. It operated under 80 lbs. air pressure; poured ½ cubic yard of concrete per blow; and made about 60 shots per hour. At most setups the forms were built to hold about 30 cubic yards of concrete, so an hour's blowing filled the forms and the placer was moved to a new location.

The concrete forms at sidewalls were of wood, but the undersides of the roof arches between the roof beams were cast on Masonite Prestwood which was bent to the required curve over wood centers. These forms could be used 8 or 10 times with satisfactory results, and it was found that the concrete required very little rubbing (and that at the joints only) to produce a good finish.

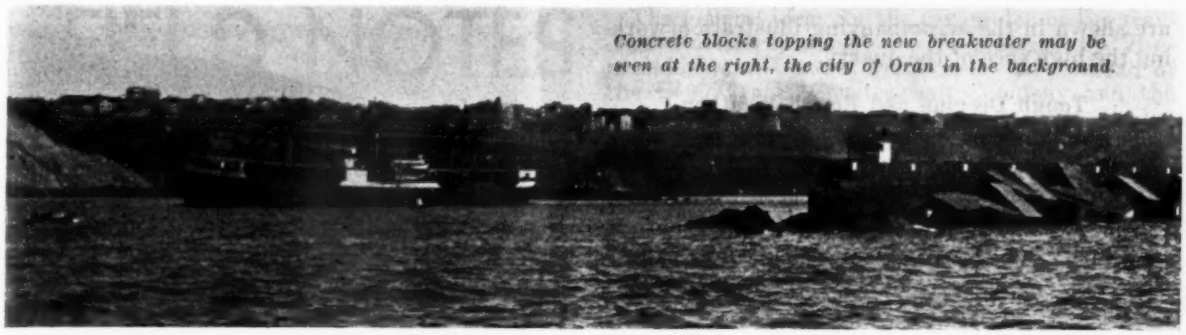
Looking west along Kingsbridge Road at the "subway sandwich." The Grand Concourse runs north and south at the top of the incline, and the subway runs between the two highways along and under the Grand Concourse.

These Men Were Responsible

Credit for the inception and successful conduct of the construction and equipment of the entire Independent System belongs to the Board of Transportation of New York, of which John H. Delaney is Chairman; Daniel L. Ryan and Frank X. Sullivan are Commissioners; and Francis J. Sinnott is Secretary. Col. John R. Slattery, Deputy Chief Engineer for the Board, was in active charge, and the Section Engineers for the Board were Frank V. Hayes on Section No. 6, and A. A. Breitenberger on Section No. 7. James B. Martin, Chief Engineer, and L. H. Usilton, Assistant Chief Engineer, were in charge for DiMarco & Reimann.

"The husband ought to have a voice in the furnishing of the home," says a woman writer.
Oh, but he does—the invoice.

"When were you born?"
"April 2."
"Late again."



Concrete blocks topping the new breakwater may be seen at the right, the city of Oran in the background.

Harbor Work in Algeria

Important breakwater extension work carried out by big French firm.

ONE of the big jobs at present being handled by the well known French Contractors, La Compagnie de Dragage & d'Entreprises Maritimes, is the extension of the breakwater protecting the Port of Oran. Oran is an important North African port, and one of the main gateways to French Morocco and Southern Algeria. It has long been in need of greater harbor protection. Hitherto this port has been exposed to the fury of the western gales, and now, to make shipping safe, an extension to the existing breakwater is under construction. M. Ligonnet, Chairman and Managing Director of the Compagnie de Dragage, is carrying out this job successfully with a full range of first-class equipment.

The nearest quarry to the port, from which the stone can conveniently be taken, is at a small place called Mers-el-Kebir, about five miles westward along the coast, and the material loaded out at the quarry is transported to the site of the work by special barges.

Quarry Face 350 Feet High

The quarry presents a high face, about 350 feet, and its length is about 1300 feet. On account of the height of the face, blasting becomes a difficult and hazardous task. Compressed air equipment, both Sullivan and Ingersoll-Rand, is used in this connection, and the face is shot and dressed by a gang working from ropes along the face. The shooting and dressing are carried on day and night, the quarry men working by the light of Jacopozzi flares.

The breakwater construction calls for a certain percentage of oversize rock, and to provide this an interesting method of operation has been adopted by the contractors. This method comprises the dual operation of caterpillar-mounted cranes and quarry type shovels. The rock is shot down in comparatively small blasts, and immediately after the face has been fired a caterpillar-mounted crane is brought up to pull out the large blocks up to about nine tons. Illustration shows one of the two Bucyrus-Erie Type B-2 machines used for this purpose. In addition to the regular crane equipment, this machine carries a drag drum, enabling it to pull a big block out of the pile from a certain distance away, until it gets it under the boom point, when the hoist line is attached and the block is loaded. After the heavy blocks have thus been removed, the rest of the blast is loaded up, quarry run, by Bucyrus-Erie 1½-cubic yard Type 42-B Ward-Leonard electric shovels. These machines

These pictures show the method of loading the large rock. Note fairlead and drag cable used to skid the rocks from the bank to a point where they can be lifted from the boom point.

are shown in the accompanying illustration working the high face of the quarry.

Tough Digging and Rough Weather

This method of operating has proved entirely satisfactory, and the cranes are loading out everything up to a maximum of ten tons.

The 42-B shovels are each averaging around 850 long tons of quarry run rock per shift (10 hours). The quarry is operated on a 2-shift basis, 20 hours per day. The output of the quarry is frequently limited by the inability of the transport equipment to function owing to rough weather, and it is anticipated that considerably higher output than the above figure will be obtained during the fine weather of the summer period.

The broken stone is handled in the quarry by narrow-gauge dump cars of about 3-tons capacity, hauled by steam and Diesel locomotives, which convey it to a loading pier close by.

Tipping Scows Bounce High When Unloaded

From this point to the breakwater site at Oran, the material is carried by a fleet of seven scows, ranging in capacity from about 250 to 450-tons each. Some of these scows are of the usual drop-bottom type, while four of them are of the tipping type. On the latter the dump is obtained by the introduction of water ballast, causing the whole barge to heel over to the extent necessary to slide the rock off the deck into the sea, as shown in the accompanying illustration. The rebound of the scow as the rock clears its deck sometimes attains as much as 20-feet and compels the scow-man, who operates the dumping device, to hold on with all his strength.

One of the tipping-scows on the way over. As the load slips off these scows bounce high . . . sometimes twenty-feet up.

This gives some idea of what the large blocks look like. They weigh up to 9-long tons and are loaded by Bucyrus-Erie B-2 cranes.

In addition to the loose rock which forms the foundation of the new seawall, large made-up concrete blocks weighing about 100-tons apiece have to be placed in position to form the top of the seawall. For this purpose the Compagnie de Dragage have in service two floating cranes of 100-tons and 150-tons capacity respectively.

With Good Towing Weather Production 5000-Tons Per Day

The accompanying illustrations show various phases of the work and speak for themselves. The contractors are exceedingly well satisfied with the performance of their Bucyrus-Erie cranes and shovels in the quarry, and the whole job is going ahead in excellent shape. The quarry is certainly one of the largest at present in operation along the North African Coast. During the month of June a total of 4½ tons of explosives were used. The daily production is at present 3,900 tons. With the fine weather and the use of a supplementary barge the production will reach 5,000 tons per day.

In addition to the machines mentioned, Messrs. Compagnie de Dragage also have a ¾-cubic yard Bucyrus-Erie Diesel shovel, which is used for miscellaneous work around the quarry.

M. Barbaroux is Managing Director of the Compagnie de Dragage et d'Entreprises Maritimes' operations in Northern Africa, and M. Rousselet is the Quarry Superintendent at Mers-el-Kebir.

Two 42-B Bucyrus-Erie Ward-Leonard electrics load the quarry run rock into 3-ton capacity dump cars hauled by Diesel and steam locomotives. The shovels carry General Electric equipment.

FIELD NOTES

Beauharnois Rip Rap Machine

THE ABOVE machine is used for placing rip-rap by the Beauharnois Construction Company. As the problem it meets is rather unusual, perhaps, a word of explanation is in order. On the Beauharnois project now nearing completion on the St. Lawrence River in Quebec (see Excavating Engineer August, 1930 and April, 1931 issues) it is necessary to rip rap 15 miles of intake canal (total 30-miles of bank) leading up stream to the power plant on Lake St. Francis. The land crossed is flat and lies, largely below the level of St. Francis hence most of the canal lies between banks built up above the surrounding country from material excavated out of the channel by tower excavators, draglines, and a hydraulic dredge.

When the contractor was ready to place rip-rap a considerable amount of heavy equipment used in construction of the power house had finished its assignment and was available for other service. Included were traveling gantries 40 feet long, of 32-foot 5-inch gauge, with center clearance above rail of 18 feet 6 inches. Each carried two derricks with 100-foot booms capable of carrying 8,000 pounds at 100 foot radius. One of these was selected for conversion to a rip-rap machine.

A skip was installed between the legs at ground level and arranged to discharge to an elevated hopper, which fed a pan conveyor transferring to a belt conveyor suspended on a boom paralleling the slope of the dike. The machine straddles a railway track on which the 20-yard side-dump cars of rock are hauled in and dumped into the skip. Before delivery to the machine the rock is put through a 48 x 60 inch jaw crusher which reduces the maximum size to between 12 and 14 inches.

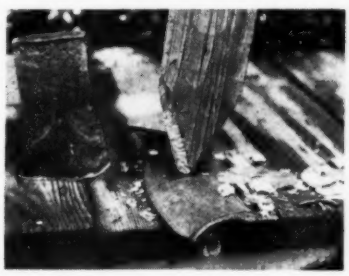
With the original gantry moves were made with a construction locomotive. The rip-rapping required greater mobility. As the new machine, weighing 560,000 pounds required frequent moves accurately controlled, and operation in freezing weather, two large 100 h.p. hoists were mounted back to back on a standard flat car ahead of the rip-rap machine. One hoist connected to two five-part lines attached to the body of the machine, the other was snubbed to deadmen attached to the rails ahead.

By a combination of swinging the boom and advancing the machine the rock was readily deposited to a uniform grade. The machine proved capable of handling a five-car train of rock in about twenty minutes. The only difficulty encountered in operation was found in maintaining a sufficiently solid road bed under the machine.

The general ideas for the conversion of the traveler to a rip-rap machine were proposed by Vice-president and General Manager F. H. Cothran of the Beauharnois Construction Company and the design was worked out by the Dominion Bridge Company, and J. A. Knight, Designing Engineer for Beauharnois Construction Company.

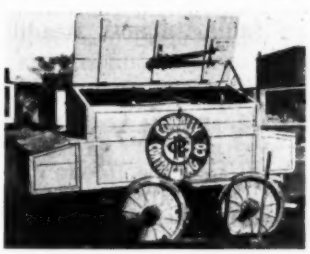
Makes Easy Job of Post or Stake Sharpening

IT IS OFTEN not an easy piece of work to sharpen a number of even small posts or stakes if the wood is fairly hard and the axe or hatchet none too razor like. Hard to find a good place to rest the end of the stake on, and it generally gets as much of the axe as the post. Dig up an old piece of tire casing about 6 by 8 inches and tack it down on one end to hold it as shown. Rest the end of the stake on the heavy rubber and try it. The stake will not so readily slip or jump. Much easier to hang on to. You will not dull the edge of the tool and will not "chew up" the plank.—*Frank W. Bentley, Jr.*



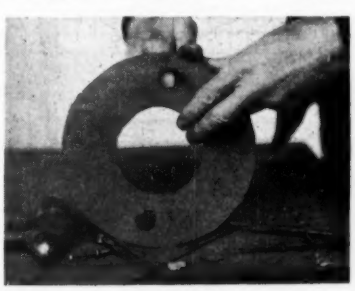
Handy Tool Box

THE ACCOMPANYING illustration shows an interesting and convenient tool box specially designed by the Connolly Contracting Company for their small jobs in and around St. Paul and Minneapolis. The box is constructed on a small trailer which may be easily hitched by a truck. Note that separate tool boxes are provided at the end which makes it convenient in case several different gangs are working on the same job with individual tools charged to each or where certain more expensive tools are to be issued only to certain responsible men in the gang. There is a step between the wheels which makes it convenient to get at the tools inside the box.



Made Good Gasket in Emergency

SEVERAL large gaskets were needed in an emergency for coupling flanges of a pipe line. The stock of sheet rubber suitable for this purpose in a small country hardware store was exhausted. Several pieces of odd linoleum were procured however, and excellent gaskets cut of it and put in place. The linoleum cut easily and nicely, drew up tight and stayed that way for the entire time needed.—*Frank W. Bentley, Jr.*



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The Business Situation

THE STATISTICAL record of the past two or three months shows enough changing trend to warrant the opinion that we are now on the upturn. In the years of 1930 and 1931 the usual Fall increase in business activity failed to develop. This year, however, this seasonal change has taken place. The Cleveland Trust Company index designed some time ago to quickly reflect changes in business fundamentals, has shown a definite improvement in the last three or four months.

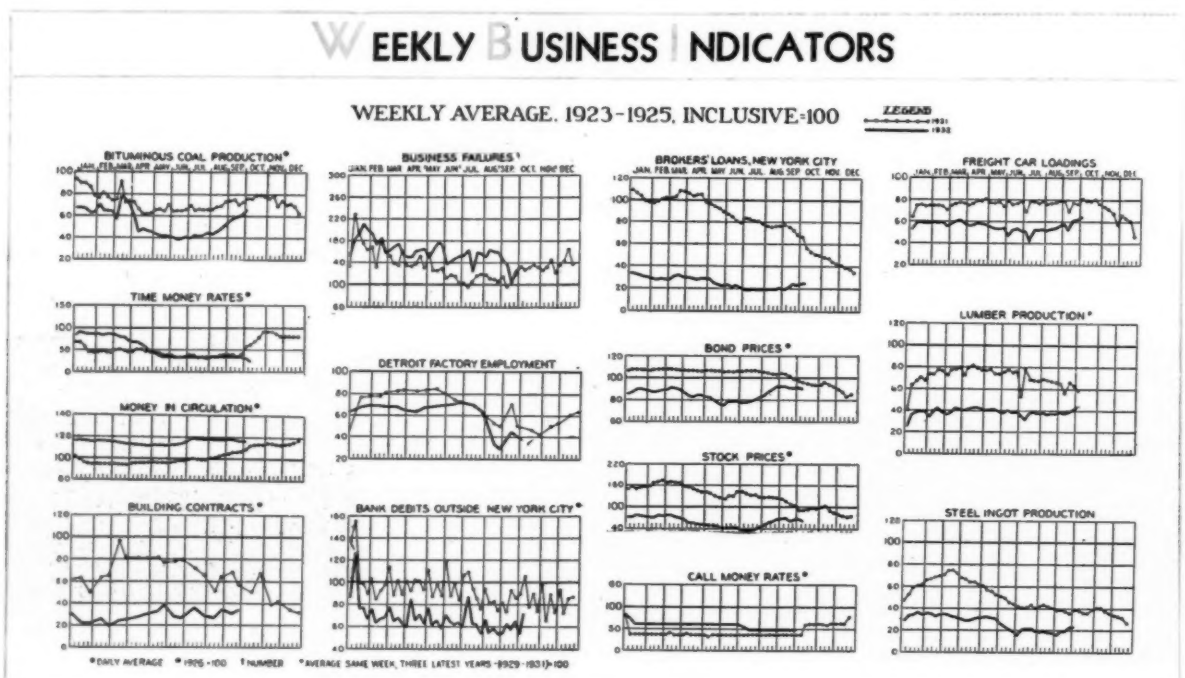
Apparently one of the most important factors responsible for the present change in trend is the termination of the financial panic which we faced last Summer. The flow of gold out of our country and its subsequent return is now an old story. Our international banking relations were seriously tested but withstood the strain. Today we find ourselves experiencing a credit expansion. The volume of bank credit has been falling almost steadily since the end of 1930. In recent weeks the curve has turned and the volume of borrowed money is gradually increasing. It is obvious that for business expansion we must have credit expansion.

The end of almost every previous, major depression has been heralded by a decided increase in activity in the textile and shoe industries. These two industries have been experiencing a considerable increase in activity during the past several weeks. They are largely responsible for the upturn in the weekly index of industrial production.

At the present moment our country is apparently in an excellent position to take prompt advantage of any increase in business activity. In spite of our country's very wide interests, the United States can be classed as primarily a manufacturing nation rather than as a producer of raw materials. The world's stock of raw materials (including coffee, silk, copper, sugar, cotton, tin, rubber, tea, wheat) has increased almost steadily since 1925. Today the composite index of the stocks of the nine items stands some 70% above where it stood three years ago. As opposed to this tremendous increase in the stock of raw materials, the domestic stocks of manufactured goods showed only a 4% increase in July, over the July of three years before. This most certainly is a promise that our industrial activity will accelerate at a faster rate than that of most other nations.

This does not mean that all our dangers are behind us. Our federal government has some serious problems to meet, such as tariff legislation, national budget deficit, war debts, national taxes and bonus demands.

An international index showing the composite business conditions in eight countries (Belgium, Canada, France, Germany, Italy, Japan, Great Britain, United States) has shown no upward turn to date, no slackening in the drop which is



usually the forerunner of upward turn. The fact that our own curve has flattened out and started upward ahead of the rest of the world, speaks well for the judgment and efforts of our present administration.

A wise and careful handling of the problems immediately ahead of us is necessary if we are to avoid a recurrence of fears for the safety of our money system and financial structures. The great depressions of the past in the 40's, the 70's, and the 90's were prolonged by threats of unsound monetary legislation in support of wildcat banking, greenback inflation, and silver remonitization. Recurrence of such unwisdom could deepen and prolong this one.

From Old Timer C. D. Walter

IN SEVERAL of our recent issues we published the request to Old Timers which appears again on this page. A number of very interesting replies have been received . . . so interesting in fact that we want more of them. This month we are reproducing the pictures and letter from C. D. Walter, Receiver for the Slavia Drainage District, Orlando, Florida.

"In reply to your "Old Timers" questions for September, I am enclosing a snap shot of one of the Rood excavators at work in St. Louis County, Minnesota. This machine would propel itself over very soft material and was, without doubt, the most successful machine of its time for use on the peat and muskeg swamps of Minnesota and Wisconsin. The writer was at one time Vice-president of a company operating fifteen Rood Excavators.

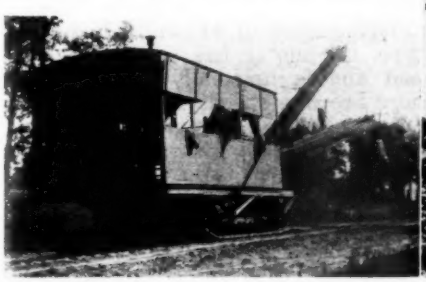
"The enclosed photo of a caterpillar machine using the Rood digging device was among the first successful endless track machines to be used on drainage work. The machine here shown, dug hundreds of miles of drainage and road ditches in Western Minnesota and Nebraska.

"The right hand picture is of a still older type, the Interstate Excavator, built by the Interstate Drainage Company, Britt, Iowa. This machine was used for many years in Illinois and Iowa and was built by the father of C. W. Rood, who was the inventor and builder of the Rood Excavator.

"C. W. Rood is a resident of Florida. Dan Brinley of Los Angeles, was an old Interstate and Rood operator. Chas. Dixon, Victor Kronholm and Peter Holberg, all living at Wisconsin Rapids, Wisconsin were operators of the Rood machine.

"I remember a Swede operator who was boasting rather strongly one day to a visitor on one of the jobs in Minnesota. The visitor, who owned a rival machine expressed his opinion of the machine in a rather sarcastic manner. He said: "I suppose you think your machine would walk on water." The Swedish operator thought the matter over and replied: "Val, a tank so, if there was yust a little mud in the water."

Thank you, Mr. Walter!
Come on Old Timers . . .
we want more!



"Rood" mounted on crawlers.

"Interstate," predecessor of Rood.

1¼-yard "Rood" on wheels.

WE WANT MORE !!!

Old Timer, Can You Answer These Questions?

Every now and then, Excavating Engineer is asked concerning some old timer, some old machine, or some old practice.

Here are some recent requests. Can you answer them? Can you supply the information asked?

Both the Questioners and Excavating Engineer will appreciate hearing from you. Published replies will be paid for.

Have you a picture of the old Cross Excavator — particularly the second machine that was built for Mathews as a back digger? Did you ever see it? Can you describe it? Where was it used?

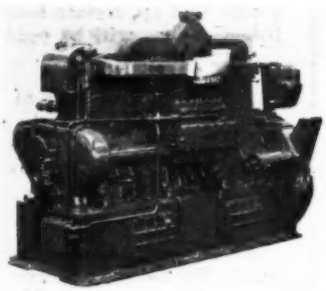
Does anyone know where "Whiskey Bill" is? Many old timers will recall that crack operator of the old days in Illinois, who was known far and wide as "Whiskey Bill". It is rumored that he is dead. Do you know? What was his last address?

Have you a snap shot or photograph of other of the Old Rood machines? Do you remember the old double boom machines that worked in Illinois, Minnesota and Iowa in the 90's? Do you know of anyone now living who operated them?

EQUIPMENT YOU OUGHT TO KNOW ABOUT

Electrically Starting on Buda M.A.N. 150 H.P. Diesel

DUE TO the high compression pressures used in a Diesel engine, it is impracticable to hand crank them as can be done with an ordinary gasoline engine. It requires considerable power to start any Diesel, and for this reason, previous engines have used either air starting or auxiliary gasoline engine starting systems.



While the older types of starting systems have proven eminently satisfactory, there has been much to be desired from the standpoint of simplicity and for this reason, this new electric starting system has been developed.

The electrical equipment used is the same in general type as is used with any automobile, but it is especially designed and constructed to produce great power. The starter uses 32 volt current and has a unique design of Bendix drive. The generator is of ample capacity to keep the batteries fully charged even when flood lights are used on the shovel. It is fitted with special voltage regulator so that the batteries will not be over-charged.

The use of these electrical starting systems makes it possible to start and stop these engines in a most simple manner. A throttle lever and a starter switch button are all that is required. To start the engine the throttle is opened and the starter button held in until the engine fires. Of course, it is not necessary to use a compression release with this electric starting. To stop it, the throttle needs only be closed. It is even more simple than handling a gasoline engine since a Diesel does not even have a choke or ignition switch.

This engine is almost the same in size as a corresponding size of gasoline engine so it will be seen that these Diesels are becoming similar in many ways to our present heavy duty gasoline engines.

Complete information may be obtained from *The Buda Company, Harvey, Ill.* Please mention Excavating Engineer when making your request.

Improved Hercules Coal Explosive

ONE OF the latest improvements in Hercules explosives, as announced by the company's technical service division, is Hercoal C-1, representing a new and improved permissible coal shooting explosive to take the place of Hercoal C.

The new explosive has satisfactorily passed all the Bureau of Mines permissibility tests and is now being placed in the field. It is stated by company officials that it is an even better lump producer and a more economical explosive than the former product.

The Hercoal series of explosives, as developed and improved by the *Hercules Research Laboratories*, are featured by their high cartridge count, economy, and the cushioned blasting effect obtained without air spacing or compressible stemming, it is stated.

FWD Announces Improvements in Standard Line for 1933

THE FOUR WHEEL DRIVE *Auto Company of Clintonville, Wisconsin,* has announced a complete new line of heavy-duty trucks for 1933. The models range in size from the 2 to 2½ ton four-wheel-drive to the 15-ton six-wheel drive, and incorporate many new improvements. Special mention is made of three primary models, featured for use in the major FWD markets; they are the H6 of 2-2½ tons capacity, for road maintenance, the CU6 of 3½-4 tons capacity, for road building and snow removal, and the X6 for milk and petroleum service. Each of these trucks incorporates the basic four-wheel-drive principle of propulsion and such refinements as are applicable to their field of use.

The CU6 of 3½-4 tons capacity is designated as the road building and snow removal truck. It has been developed over a period of several years and the earlier models are known to practically every state highway department in the United States. The new model for 1933 has a decided improvement in appearance and many mechanical advantages over its predecessors. The new cab is of the aero-dynamic type with an internal sun visor and has all the appointments of a pleasure car, including rear-view mirror, windshield wiper, and a redesigned dash with indirectly lighted airplane type instruments in a unit panel. Side vents at either side of the floor board and dual rear windows provide ample air circulation for hot summer days.

The motor in this model is a six-cylinder seven-bearing crankshaft unit, rated at 91 horsepower with a piston displacement of 411 cubic inches. Of the L head type, the motor has a Ricardo high-turbulence head and is unusually economical in operation. There are five speeds forward and one reverse in the heavy-duty sliding jaw clutch transmission, providing a speed of 32 miles per hour in the standard 7.35 to 1 gear ratio. Optional ratios give speeds of 19.5 miles per hour to 41 miles per hour in high gear, depending on the customer's requirements.

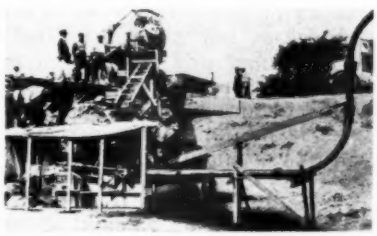
The wheelbase is 147" with three others optional, that is, 159", 169", and 179" can be furnished if de-

sired. The tread has been increased from 60 to 72 inches and the motor, transmission, etc., lowered four inches, thus lowering the center of gravity and securing better roadability. The turning radius is also shortened considerably by the increase in tread width. The regular set-back front axle design is employed as in former models.

For complete information address Four Wheel Drive Auto Co., Clintonville, Wis., mentioning Excavating Engineer.

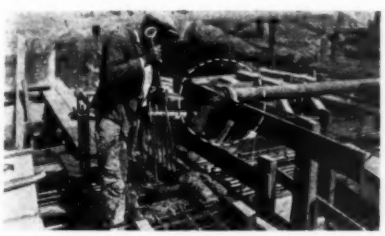
Concrete Pumped to Forms

FOR THE first time in America concrete was pumped to the forms in quantity when the Pumpcrete, owned by the *Chain Belt Company*, went into action on the Thirty-fifth Street Viaduct in Milwaukee, on August 11, 1932.



Pumpcrete is a concrete pump, developed in Europe for delivering concrete to the forms by direct pumping action, and apparently is the successful solution to a method of placement by direct pumping that has long interested concrete engineers.

The Milwaukee demonstration lasted twelve hours, during which the Pumpcrete handled 125 yards of mixed concrete to forms, including 1½ hours' idle time waiting for delivery.



The pump is of the piston type, gasoline or electric motor driven, has a capacity of 15 to 20 yards of concrete per hour, and is portable. It will transport concrete 500 feet horizontally, or up to 72 feet vertically.

In the Milwaukee test, concrete of standard mix was delivered in Moto-Mixers to the hopper of the pump, the gasoline motor was started and the Pumpcrete started on its highly successful test through the full working day and well into the night. The Concrete, as it was delivered to the forms, was rigidly inspected, and its quality, if changed at all, was said to be somewhat improved.

Five-inch pipe was employed in the pipe line and the aggregates of relatively large size were moved through it, all day long, without a bobble. The pipe used was in 10-foot lengths, equipped with quick couplings.

At one time the pump was stopped for half an hour while waiting for concrete. The Pumpcrete, however, took up its methodical turnover again, moving the mass through the pipe line, with no more apparent effort than the first batch.

The Pumpcrete is to be manufactured and distributed in America by the Chain Belt Company of Milwaukee, makers of Rex Concrete Mixers, Pavers and Moto-Mixers, who have purchased the American manufacturing rights from the German-Dutch combination who developed it and patented it throughout the world.

New Larger Trackson Wagon

TRACKSON COMPANY, *Milwaukee, Wis.*, announce the "Levee Special," a larger capacity crawler wagon especially constructed for dragline loading. This new Trackson product has a water measure capacity of 9 cu. yds., or 11 cu. yds. heaped materials, and provides approximately forty percent greater capacity in comparison with their standard 7-8 yd. wagon. It is intended for use in conjunction with larger sized draglines and crawler tractors now coming into general use on large earth moving projects, particularly on levee construction work along the Mississippi River.

Like the standard 7-8 yd. Trackson Crawler Wagon, the "Levee Special" is of the bottom dump, cart-type. Unloading takes place through the full-length bottom doors and consequently the load is dumped almost instantaneously. Approximately ninety percent of the total load is carried on crawler wheels with the remaining weight overbalanced onto the tractor through the rigid tubular tongue. In addition to the load being supported entirely by crawlers, the cart-type has the added advantage of being practically proof against jack-knifing in descending steep grades.

The Trackson "Levee Special," according to the manufacturers, has several features new to crawler wagon design. The crawler wheels, for instance, are so constructed to equal the rolling efficiency of a pair of huge wheels approximately 48 feet in diameter. The arch in Trackson Crawler Wheels which makes this comparative efficiency possible is readily renewable at low cost. Crawler wheels that have been in service for over 5,000 hours have been completely re-arched and are serviceable as new.

When writing Trackson Company we will appreciate your mention of Excavating Engineer.

Bigger TracTracTor

ANOTHER ADDITION to its crawler tractor line, announced by *International Harvester Company, 606 So. Michigan Ave., Chicago,* is the new compactly built Model T-40 six-cylinder TracTracTor.

The T-40 develops a maximum drawbar horsepower of 40 and a maximum engine horsepower of 52, and is especially well suited for heavy construction work, such as road, dam, levee, irrigation and oil-field work, logging, etc. In operating bulldozers, backfillers, shovels, and snowplows and pulling crawler wagons, scrapers, and graders, the new crawler is at its best.

Features worthy of particular mention include: accessibility of working parts, special dust seals guard every shaft and bearing, five forward and one reverse speeds, light weight per unit of track

(Continued on page 547)

Distinguishing Characteristics of Shovel Motors

Why and How They Differ from General Service Motors

By J. E. Borland, Gen. Engineer,
Westinghouse Electric & Manufacturing Company

IT IS a generally recognized fact that the severity of power shovel service requires a high order of design and construction, both electrical and mechanical, to secure the economy and reliability characteristic of electric drive. This is particularly true of the direct current motors used to drive the three main motions of the shovel. These motors are subjected to rapidly varying loads over wide ranges, with sudden peak demands and high speeds in each direction of operation. They must also withstand the vibration originating in gears and in other moving parts and in the pitching and rotation of the shovel cab.

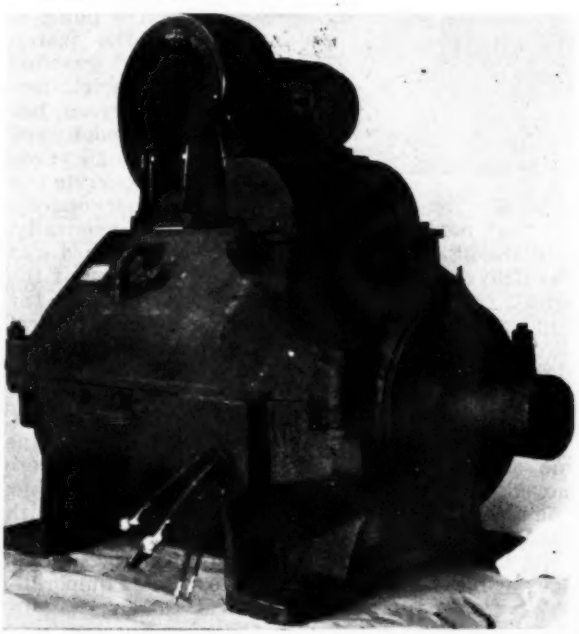
The design of the shovel motor has evolved from that of the mill motor developed over a long period of years and widely applied in heavy duty service such as on steel mill auxiliaries, heavy material handling machinery and similar applications. In the shovel motors all the desirable features of the older line of motors have been retained with added improvement to set a new standard of service. All details of the motors are of sturdiest construction, to operate over long periods with a minimum of expense and delay in maintenance. Provision is made for ready accessibility of interior parts, for inspection or replacement, if necessary.

On a simple application such as a blower drive the motor is started on rare occasions and is required only to operate at some constant speed with little or no variation in demand. At the opposite end of the scale we possibly find shovel motor applications where in one instant it may be subjected to peak demand as a motor and in the next instant as a generator, returning power to its motor generator set. During all of this its speed is being changed almost constantly as is indicated by the graphic speed chart Fig. 1 taken on the swing motor of a large shovel. This chart indicates the motor accelerates at the rate of 250 R.P.M. per second and retards at the rate of 300 R.P.M. per second. On this particular test the motor completes 2½ of these cycles in a minute. If this service were continued for 6000 hours per year over 900,000 complete cycles of reversal would be accomplished. To retard the armature alone of this particular motor at the rate of 300 R.P.M. per second requires 20% of its full load torque. This percentage would be higher if it were not for the fact that great care has been exercised in providing motors having low inertia in their rotating parts. Of course, each of the three motors usually supplied on an electric shovel is required to accelerate and retard other moving parts than its own. This is particularly true of the swing and hoist motor.

The problem of the motor design engineer for an application of this type is most exacting. To withstand these constant reversing peak loads requires the sturdiest of mechanical construction and the problem of insulation is one of not only dissipating high losses but also of protecting the electrical parts against any mechanical movement relative to its armature. To not only reduce the mechanical shock but also keep the electrical losses and heating to a minimum the inertia of the armature is kept to a minimum.

Inertia Must Be Minimized

While the actual moment of inertia of the motor armature may be small in comparison with the inertia of other parts of motion, particularly on the swing, the higher speed of rotation of the motor, driving through reduction gearing of large ratio, makes its effective inertia a considerable part of the total effective inertia of the system. On the hoist and crowd motions the motor inertia will be a still greater part of the total.



Westinghouse shovel motor illustrating some of the features discussed in this article.

In the design of shovel motors, to keep the inertia at a minimum, armatures of small diameter are used, with length sufficient for the required rating. Care is taken to secure the most efficient use and distribution of active materials, and in-

active parts such as coil supports, blower and so forth are designed and placed to add as little as possible to the total inertia of the armature.

Meeting the Heat Problem

In most classes of service the shovel is in more or less steady operation throughout the working shifts, requiring high continuous ratings in the driving motors. To meet this requirement, the motors are arranged for the best practicable self-ventilation, obtained by the use of a blower on the motor shaft, where necessary to supplement the inherent blowing action of the armature winding. Proper disposition of armture and field windings assures that the flow of cooling air reaches all parts where heat is developed. Where continuous ratings higher than obtainable on the self-ventilated design are needed, a separate motor-driven blower is used to force additional ventilating air through the windings. With the motors continually starting and stopping they are constantly subjected to heavy starting and retarding currents. Considering this feature only a liberally designed motor would be the natural thing to supply but this would result in a rotor with unnecessarily high inertia. This situation is further complicated where the completely enclosed motor is supplied since it is more difficult to dissipate the heat generated from these heavy currents than in an open motor. Where artificial ventilation is not provided the natural ventilating effect of the armature is not available at times when the motor is at rest and of little value when its speed is near zero. To meet these conflicting requirements a compact rotor is provided with fire-proof insulating material that will stand high temperatures.

The windings are insulated throughout with mica and asbestos, which are capable of resisting high temperature without injury. As the standardization rules of the A.I.E.E. specify a maximum temperature limit of 115° C. by thermometer for these materials, the motors are rated on the basis of 75° C. maximum observable rise over an ambient temperature of 40° C., allowing 10° C. additional rise to the interior of the coils.

Armature coils are of asbestos covered wire or mica-insulated strap, completely formed to shape before being placed in the slots. The slot portions of each coil are insulated with a mica wrapper and the coil is covered overall with a layer of asbestos tape. During the process of insulation in some designs, the coil is given several treatments with insulating compound and the slot portions are hot-pressed to insure uniformity and a tight fit in the slot. A hard solid coil permits a more rapid flow of heat than one in which air spaces are left and every effort must be made to transfer the heat generated in the copper to the outside of the motor.

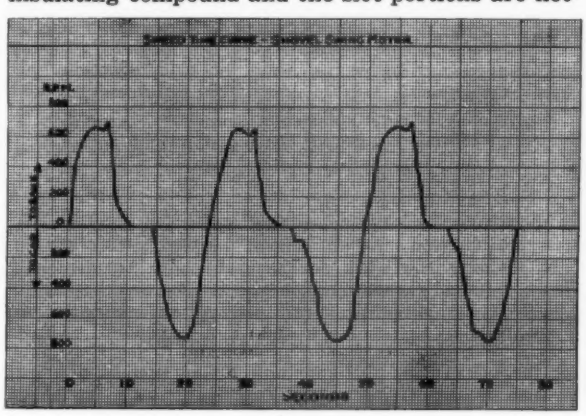


Figure 1

Special Construction in Banding

Special construction is used in banding the armature over that which is generally used. Ordinarily armatures are not only banded at the ends but also at one or more points over the armature core but it has been found that eddy currents are generated in bandwires where they are under the influence of the field, particularly when the armatures are rotated at high speeds. This would, of course, add to the heat normally generated by the heavy starting and retarding currents in the armature coils themselves. To avoid this these coils are held entirely at the front and back. In assembly of the winding, temporary bands are first applied, with the armature hot, pulling the coils down snugly in the slots. The complete winding is then dipped in insulating compound and baked hard. After cooling, the temporary bands are removed and permanent banding applied. This banding is soldered with high melting point solder and is placed so as to be out of the action of the main field of the motor, to prevent the extra heating and possible loosening of the band under the eddy current losses, when operating at high speed.

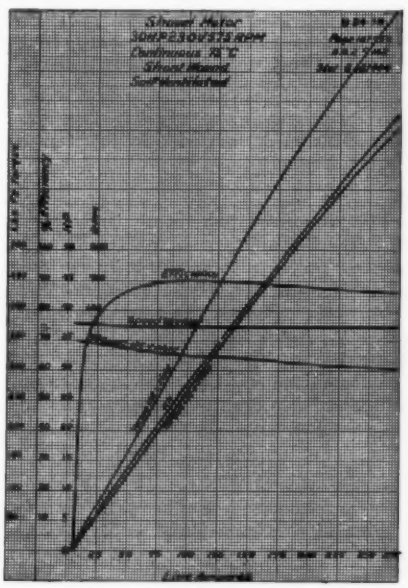


Figure 2

Shovel motors generally employ shunt wound fields, supplied from a separate 125-volt exciter. This form of excitation has been found preferable in most cases, as it eliminates the need of heavy reversing switches or other auxiliary apparatus necessary with series or compound-wound motors on reversing service. It also permits the use of regenerative braking in lowering the dipper and in retardation of the different motions.

Field windings are designed for an excitation voltage of the order of 70 to 90 volts at rated motor speed, allowing a margin in excitation voltage to force the fields on the high torque points of the control. This causes the motor to develop a higher torque for a given armature current and saves something in the losses and heating in the armatures of the motor and its generator. If the fields were designed for the full 125 volts generated by the exciter their time constant would be slower than that obtained when designed for some lower

(Continued on page 547)

SHOTS FROM THE FIRING LINE

Contracts for Over 40 Million Yards of Levee Building!

THE U. S. Engineers in charge of Mississippi River flood control work are certainly to be highly complimented on the most efficient and expeditious manner in which the large lettings in October at the various offices were handled.

At Memphis on October 4th the District Office handled the largest levee letting in the history of the River. Ten low bidders were recommended for the awards on 40 projects totaling 19,467,000 cubic yards at a total cost of $3,033,918. There were forty-eight bidders.

At Vicksburg on October 7th, 6,120,000 yards were bid in nine projects which went to three of the 20 bidders.

At New Orleans on October 11th, 26 projects involving 13,390,000 yards were let in the Tensas and Atchafalaya Basins.

On October 18th projects involving 3,650,000 yards in the Lower St. Francis District are being bid at Memphis.

For successful bidders on the levee projects see River Notes on Page 536.

Oregon Highway Department Abandons Force Account Hand Labor

IN A RECENT announcement by Leslie M. Scott, Chairman of the Highway Commission, is an interesting and convincing indictment of the force account hand labor system which has been advocated by certain people as a relief for unemployment. In summarizing the situation which led to the decision by the Oregon State Highway Department to abandon force account hand labor and revert to the contract plan in its new program which calls for expenditure of $3,000,000 of federal funds, Mr. Scott states, as quoted in the Oregonian:

"Oregon has spent $1,500,000 this year for hand labor relief employment by force account. One-half that sum would have done the same work on a competitive contract basis. But the present usable value of the work done is much less; probably not more than 10 per cent of the sum expended. Relief employment by force account, spread widely over the state on many projects as was done last winter and spring, is deplorably wasteful of public funds; consumes careful economies made in other directions; causes work to be done where it is not needed for practicable highway purposes, or will not be used by the highway system for many years.

"The efficiency of such work ranged from 30 to 70 per cent and averaged 50 per cent or less, and most of the work was placed where not at present usable, just to satisfy local demands for home employment."

He cited a letter of August 16, addressed by Thomas H. MacDonald, chief of the federal bureau in Washington, D. C., to Senator McNary, in which it was stated that hand labor by force account on seven of ten federal-aid projects in Oregon "resulted in a cost more than double the amount the same work was estimated to cost," the totals being $419,883.36 (cost) and $206,622.90 (estimated).

In common excavation on one project, which was partly done by force account hand labor and later finished by contract, the costs per cubic yard were 50.7 cents (hand labor), 20 cents (contract), 30 cents (estimated).

"I feel that you will agree with me," Mr. Scott quoted the letter, "that there is no reasonable economy in the use of road funds for work undertaken on this basis.

"The Federal Bureau of Roads and Reconstruction Finance Corporation, in abandoning the charity or dole plan of relief employment in dealings with the state highway department, hold that the department is not a poor relief agency and will not be supplied with federal funds as such; that the legal and proper agency of relief is the county; and that highway work paid for with federal construction funds shall be done through contractors, who shall have full power to hire and fire," Mr. Scott continued. "In special cases, where work is approved for force account conditions, the federal participation must be limited to estimated unit prices."

"We have spent $1,500,000 for employment of those who 'lean on their shovels'," Mr. Scott said. "We have spent an additional $3,500,000 on contract work. We have gone into debt for these unemployed. Should we wreck the finances of Oregon for the purpose of 'saving humanity'?" he asked. "I say no."

During the winter and spring 3000 men will be employed on a contract basis on 35 to 37 projects throughout the state, he explained. They will be paid a minimum of 50 cents an hour for 30 hours' work a week. . . .

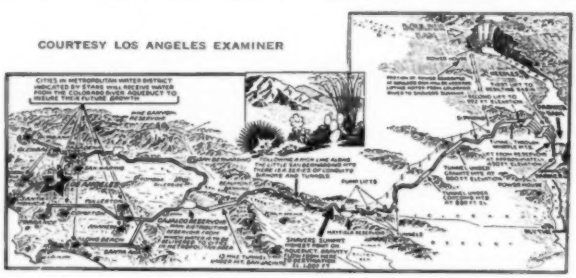
"We will adopt a medium ground between hand labor and the use of machines. Machines will not be abolished. . . . It costs 50 cents a cubic yard to excavate with hand labor while a power shovel could do it for 8 cents."

On one job, "we could have paid the men their wages while they sat aside and drank lemonade and played cards as a power shovel did the work and still it would have cost us only 43 cents a cubic yard," Mr. Scott declared.

First Section, Metropolitan Aqueduct to be Let Soon

BIDDING has tentatively been set for November 29th by the Los Angeles Metropolitan Water District of 306 West 3rd Street, Los Angeles, for the construction of the San Jacinto Water Tunnel which is to be 67,408 feet long and 16 feet in diameter. It will be in horseshoe section with adits and shafts extending from West Portal at a point three miles north of San Jacinto through the San Jacinto Mountains to a point 2 miles south of Cabazon near Banning. Bids will be accepted on three schedules: Number one for the entire tunnel; number two for the East half of the

COURTESY LOS ANGELES EXAMINER



tunnel and number three for the West half of the tunnel. Quantities involved in the entire tunnel are:

215	lin. ft. excav. East Portal adit.
1,500	lin. ft. excav. Cabazon adit.
2,600	lin. ft. excav. Potrero adit.
185	lin. ft. excav. West Portal adit.
750,000	cu. yd. excavation tunnel.
200	cu. yd. excav. tunnel enlargement.
200	cu. yd. concrete—Cabazon adit.
300	cu. yd. concrete—Potrero adit.
195,000	cu. yd. concrete tunnel.
2,250	M. ft. BM permanent timbering.
500,000	lb. steel support in tunnel.
250	cu. yd. gunite coating of tunnel rods.
200	connections for grouting.
350	cu. yd. mix and place grout.
500,000	lb. place reinforcing steel.
270,000	cu. yd. mi. overhaul concr. aggregates.
150,000	ton mi. haul cement and steel.

In dividing the work for separate bids 340,000 cubic yards of tunnel excavation comes in the Eastern half while 410,000 cubic yards of tunnel excavation comes in the Western half.

F. E. Weymouth is Chief Engineer and General Manager for the Los Angeles Metropolitan Water District and will be glad to furnish plans and specifications on the above work at $5.00 per set. (no refund.)

Three Million Yards of Railroad Grading on Dotsero Cut-off Let

THERE were a total of 19 bids offered on the Dotsero cut-off work for the D. & R. G. Railroad at Denver, Colorado, for which bids closed October 15th.

It is reported that the successful bidders were a combination of three firms included in the Six Companies; W. A. Bechtel Company, Utah Construction Company and Morrison-Knudson Company. These companies jointly submitted a bid of approximately $2,000,000. The contract which is for grading only contains 800,000 yards of solid rock, 1,200,000 yards of loose rock, 400,000 yards of common dirt, and 600,000 yards of borrow for the total of 3,000,000 yards.

Other low bidders were List Construction Company, Winston & Company, Hamilton & Gleason, and Peterson, Shirley & Gunther.

More Roads for Less Money is Paving Conference Theme

THE TENTH annual Asphalt Paving Conference will be held at the Roosevelt Hotel, New Orleans, from December 5th to 9th with a business and technical program designed to consider current problems of most importance to national, state and county highway officials, engineers, technologists and contractors. An entertainment program has been designed so as to make the Crescent City trip memorable for all who attend the meeting. The conference will be held under the auspices of the Asphalt Institute of New York and the Association of Asphalt Paving Technologists.

J. E. Pennybacker, Managing Director of the Asphalt Institute and in charge of all arrangements, has announced that scheduled highlights include an explanation by S. S. Lewis, Pennsylvania Secretary of Highways, of how that state is successfully solving its farm-to-market road problem, and an address by Thomas H. MacDonald, Chief of the United States Bureau of Public Roads. Representatives of seventy-five asphalt road equipment manufacturers will contribute authentic information on the latest technical developments pertaining to roadbuilding, thus making the conference serve as a clearing-house of the latest advances in road construction. Because the ever-increasing diversion of gasoline tax funds from roadbuilding purposes, amounting to more than $20,000,000 last year, threatens the existence of gasoline taxes as a main sinew of roadbuilding, W. R. Boyd, Executive Vice-President of the American Petroleum Institute, will deliver a comprehensive address on that subject.

National Paving Brick Association Will Participate in Highway and Building Congress

THE ANNUAL meeting of the National Paving Brick Association will be held at the Book-Cadillac Hotel in Detroit, January 17-18, 1933. The sessions on January 18th will be open to the general public. Anyone interested in street and highway development is invited to attend.

The program, now under preparation, will be presented by prominent engineers, contractors and paving authorities. It will include descriptions of recently constructed brick highways, streets and boulevards. There will be discussions of the application of highway research to modern brick pavement design, including filler and cushion construction. How unemployment has been relieved by turning over and relaying old brick pavements, after a generation of service, will be described. Brick for resurfacing worn pavements and bases, an important and increasing utilization, will be a prominent feature of the program.

O. W. Renkert, Metropolitan Paving Brick Company, is President, and George F. Schlesinger, formerly State Highway Director of Ohio, is Chief Engineer and Secretary of the National Paving Brick Association.

The National Slag Association announces the removal of their office to 1449 Leader Building, Cleveland, Ohio, as of October 10, 1932.

He—"People living together get to look alike."
She—"Here's your ring. I won't take the chance."

The Great Lakes-St. Lawrence Deep Waterway

THE GREATEST internal improvement yet undertaken on the North American Continent," is President Hoover's description of the Great Lakes-St. Lawrence Deep Waterway Project, for which initial engineering preparations have been under way for some time. The first general engineering description of the gigantic undertaking appears in the current issue of "The Explosives Engineer."

While many of the preparatory steps toward putting the inland part of North America in direct ocean-going connection with all parts of the world have been taken, the major undertaking, which will involve an ultimate expenditure of some $543,000,000, now awaits ratification of the recently signed treaty between the United States and Canada.

The major portion of the new construction work, to overcome navigation obstacles and provide power under the terms of the treaty, lies in the international Section and Canadian Section of the St. Lawrence River, between Lake Ontario and Montreal.

Plans for the Deep Waterway were based on years of study, the original investigation on the project having been undertaken in 1902. In 1924 when President Hoover, then Secretary of Commerce, was chairman of the St. Lawrence Commission, a joint Board of Engineers was created which submitted definite recommendations in 1926. After further study, the final report was submitted in 1932, providing the basis for the treaty which was signed in July.

Some of the problems involved in the project, described in "The Explosives Engineer," are the maintenance of the lake levels on several of the Great Lakes, regulation of flow, maintenance of proper heads at various power plants, preservation of Niagara Falls, dredging and enlarging of existing channels and locks, and the building of two large dams in the International Rapids Division.

A number of the specifications and costs and frequent quotations from the International Treaty are found in the article. Reprints are available, free, to interested parties, who may write for them to "The Explosives Engineer," Wilmington, Delaware.

Westinghouse Buys Copper

ORDERS for four million pounds of copper, an amount far in excess of current business demand, have been placed by the Westinghouse Electric and Manufacturing Company, according to an announcement by F. A. Merrick, president of the company. This large scale commitment at this time, according to Merrick, is influenced by sound economic factors, a firm belief that business has actually turned the "corner" and as a step to stimulate employment in the basic industries.

"The world isn't finished," stated Merrick, "and as electricity plays such a large part in our lives today, we are hopeful that even these large reserves of copper will shortly need replenishment. We foresee other opportunities for purchase of materials and supplies which we hope to take advantage of at the present favorable price levels.

"It is my conviction," concluded Merrick, "that the work of the Committee on Industrial Rehabilitation together with other forces at work will in a short time provide the stimulus to re-establish individual purchasing power, expand credit, and return many of our unemployed to gainful occupation."

Bids November 15th for San Gabriel Dam No. 1

AFTER twice rejecting all bids it is reported that a third bidding on San Gabriel Dam No. 1 is to be held November 15th. This is one of the largest projects in Southern California. New plans and specifications have recently been completed.

A society woman wrote to an army officer: "Mrs. John Sears De Ville requests the pleasure of Captain Smith's company at a reception on August the sixteenth."

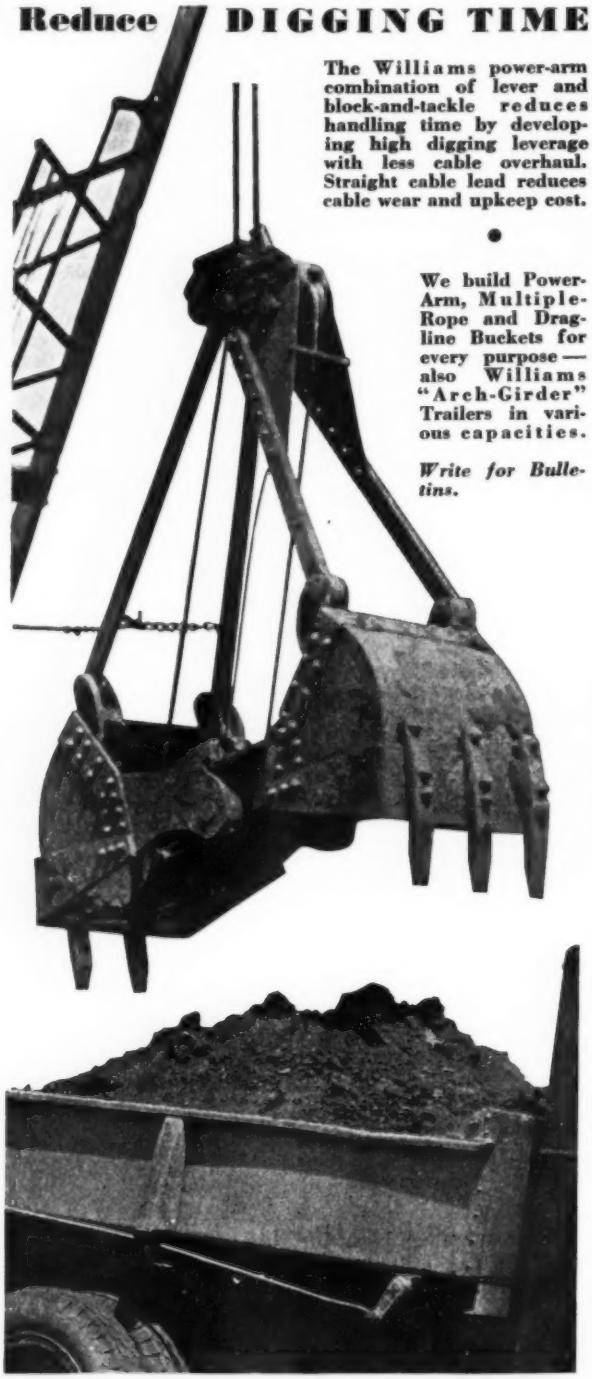
The next day she received this note of acceptance: "With the exception of fourteen men who, I regret to say, have a week each in the guard house, Captain Smith's company accept with pleasure Mrs. De Ville's invitation for August the sixteenth.

WILLIAMS
"Champion" Buckets
Reduce DIGGING TIME

The Williams power-arm combination of lever and block-and-tackle reduces handling time by developing high digging leverage with less cable overhaul. Straight cable lead reduces cable wear and upkeep cost.

We build Power-Arm, Multiple-Rope and Dragline Buckets for every purpose — also Williams "Arch-Girder" Trailers in various capacities.

Write for Bulletins.



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Shots From the Firing Line — *Continued*

R. F. C. Loan Authorized for 7½ Mile-San Francisco-Oakland Bridge

THE RECONSTRUCTION Finance Corporation recently authorized a $62,000,000 loan to the California Toll Bridge Authority for the bridge across San Francisco Bay to Oakland via Goat Island. This new bridge is planned to span the 5-miles of water barrier between San Francisco and the cities on the East side of the bay. Its total length including approaches is 7½ miles. It includes a 2,310 foot suspension span over the West Channel, a tunnel through the hills on Goat Island and a 1,400 foot cantilever span over the East Channel. The total cost is estimated at $70,000,000.

The foundation work on the bridge is estimated to cost $15,240,000 and is expected to be advertised immediately as soon as the State Legislature takes care of certain requirements laid down by the R. F. C.

$5,784,000 to Middle Rio Grande Flood Control District

FOR THE continuation of work extending along the Rio Grande for nearly 150 miles near Albuquerque, New Mexico, R. F. C. authorized a loan of $5,784,000 to the Middle Rio Grande Flood Control District. About $3,000,000 has already been spent on the project. This provided for 152 miles of levees, one diversion dam, 20 miles of main canals and 56 miles of draining channels. Additional work on the project includes 31 miles of levees and three more diversion dams. One of the dams to be constructed is on the Rio Chama, a tributary of the Rio Grande above Albuquerque. This structure, 175 feet high with a reservoir having capacity of 198,000 acre feet, provides flood control and water for irrigation. Employment of 2,200 men for three years will be provided.

Estimating Construction Costs

WITH THE possibility of an industrial revival, when federal relief funds find their way to new construction work, the Extension Division of the University of Wisconsin, at Madison, is offering the advantages of its training courses in the field of construction, given by correspondence study for men in any state.

Its 20-assignment course entitled "Estimating Construction Costs," new this year, is being presented as a foundation study for men ambitious to advance in construction work.

The study is designed for the needs of estimators, engineers, designers, architects, and contractors. According to Professor H. E. Pulver, in charge, the course embodies the use of charts for recording the student's own cost data, and simplifying his estimating problems with the least effort.

The subject matter includes estimating costs of transportation and handling of materials, piling, excavation, concrete, wood construction, brick, tile, stone, structural steel, lathing, plastering, roofing, flashing, waterproofing, pipe work and heating, plumbing, electrical work, painting and glazing, paper-hanging, machinery and its erection, also overhead, prices of construction, and construction management.

Foreign

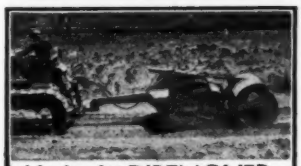
China

Much interest was displayed throughout China in the opening on October tenth of the new 120-mile Shanghai-Hangchow Highway including steam ferry service at Minghong. This road, with the additional 200-mile highway between Hangchow and Nanking, demonstrates the first practicable long-distance highway in China. While the road does not compare with American standards, the event is epoch-making as the beginning of a national highway system open to private motorists and is doing much to advertise the value of motor roads.

It is reported that the proposal calling for the appropriation of $10,000,000 from the Boxer Indemnity Refund as a

For your convenience in writing to The Wellman Engineering Co. you will find a card bound in this issue.

Low Cost DIRT MOVING



Hydraulic DIRTMOVER

WAGON GRADER

BULLDOZER

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with a Blaw-Knox (Ateco) HYDRAULIC DIRTMOVER

The actual cost figures of practical and very capable contractors prove that the Blaw-Knox (*Ateco*) Hydraulic DIRTMOVER is the real "find" of the last few years in connection with all dirt moving and grading operations.

Here is a machine which moves dirt, excavates, shoulders, spreads, fills and compacts—as cheap as 5c per cu. yd. *and lower*, depending upon dirt conditions and length of haul.

Contractors who are interested in LOW cost dirt moving and grading come to Blaw-Knox for Hard Digging Clamshell Buckets . . . efficient Dragline Buckets . . . one man Blaw-Knox (*Ateco*) Hydraulic Dirtmovers, Bulldozers, Tamping Rollers and Scarifiers. Blaw-Knox Dirt Moving Equipment is highly efficient—sturdily built. Designed for long life with minimum expense for upkeep and repairs.

Fill in and mail this coupon

BLAW-KNOX COMPANY,
2018 Farmers Bank Building, PITTSBURGH, PA.
Please send me the following catalogs:
Blaw-Knox Dreadnaught Buckets _____
Blaw-Knox Dragline Buckets _____
Blaw-Knox (Ateco) Dirt Moving Equipment _____
Name _____
Company _____
Street _____
City _____ State _____

BLAW-KNOX

When writing to Blaw-Knox Company please use coupon or card bound in this issue.

Shots From the Firing Line — *Continued*

loan to the Kiangsi Provincial Government for the construction of motor highways in that province has received the official sanction of the Central Authorities. The project provides for the building of trunk lines connecting the important cities of Kiangsi with the Provinces of Chekiang, Fukien and Kwangtun, so as to facilitate inter-provincial communications.

Early completion of the Tihua-Hsinghsinghsia section of the **Kansu-Sinkiang National Highway** has been ordered by the Chinese Ministry of Railways. This section covers about 315 miles, part of which has been completed. The Ministry also has issued an order to the Suiyuan Reconstruction Department for the early construction of the Pingtichuan-Pangkiang highway of about 150 miles, an important artery in the proposed network of communications in the northwest. The Chekiang Reconstruction Department has decided to complete eight highways during the present year.

Philadelphia and Vicinity

By M. G. CONWAY

Operator Samuel Morris of Dallas, Pa., sends this picture showing what a real dipperful looks like. The machine is **Joseph Herzog's** Bucyrus-Erie Type B steamer working on road construction on Route 415 Luzerne County, Pennsylvania. Sam is at the levers "in person" while "Swamper" Jones left the boiler long enough to get into the picture.

The Standard Concrete Steel Company have announced the removal of their office from 217 North Calvert Street to 100 W. Monument Street, Baltimore, Maryland.

Southern Notes

The H. B. Nelson Construction Company have announced the removal of their main office from Columbus, Georgia, to No. 305 Red Rock Building, Atlanta, Georgia.

Florida Notes

Spedara Construction Company of Brooklyn, New York, was low bidder October 5th at the Jacksonville U. S. Engineers Office for 97,900 linear feet of levee and floodway along the west shore of Lake Okeechobee. The work involves items of 720,000 cubic yards and 6,700,000 cubic yards. Sperada Construction Company were $269,850 below the field. H. J. Sternberg and Wilbanks and Pierce, bidding together, were second low but were $39,623 above the Government estimate.

Delaware Notes

Old Line Construction Company of Chestertown, Maryland was low on two of the projects bid September 13th; contract number 191, 3.6 miles at Georgtown of $41,982 and contract number 249 consisting of 2.9 miles from Frankford to Dagsboro for $55,649.

Vincent Schiavi of Townsend, Delaware was low with $84,040 on the 3.22 miles of grading from Bear to Hare's Corner. This contract consists of 80,000 cubic yards of excavation and other miscellaneous items.

Olivere Paving & Construction Company of Wilmington, Delaware with a bid of $24,600 was low on the 30,000 cubic yards of borrow from Chestnut Street Cutoff to New Castle.

"What do you do for a livin', Sambo?"
"I'se de manager ob a laundry."
"What's de name of de laundry?"
"Eliza Ann."

Kentucky Notes

By W. E. CHAMBERS

Vincennes Bridge Company with their bid of $8,977 was awarded the contract for a timber bridge over minor slough on Wickliffe-East Cairo Road in Ballard County.

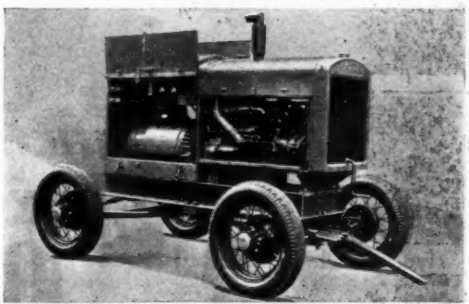
Ralph E. Mills, Frankfort, with bid of $185,944, received contract for grading 9 miles of road in Barren County. This cost is to be met entirely by Federal funds.

Robert M. Robinson was awarded contract with a bid of $16,676 for grading 4 miles in Hopkins County.

Carey Reed Company of Lexington with a bid of $211,997 was awarded the contract for surfacing and draining 8.3 miles in Logan County. This cost is to be met entirely by Federal funds.

Ross Construction Company of Columbus, Georgia, with a bid of $80,117 was awarded the contract for 8.3 miles of grading in Metcalfe County. This cost is to be met entirely by Federal funds.

Cut Your Costs



On Machinery Repairs

Resurfacing dipper teeth, repairing broken castings or cracked plates, renewing dredge bucket lips—there's a thousand different maintenance jobs on which the P&H-Hansen Welder can save you time and money.

The P&H-Hansen is built by the manufacturers of the famous line of P&H Material Handling Equipment. It is easily portable, is inexpensive, and extremely simple to operate. Only one adjustment is necessary for controlling the welding current—you don't need any expert operator to get good results with the P&H-Hansen gasoline powered Welder.

Write today for full particulars and for our new 20-page booklet, *"WELD IT WELL."*

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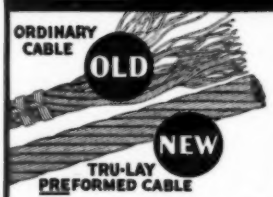
P&H-HANSEN ARC WELDER

AMERICA'S FINEST FASTEST WELDER

TRADE TRU-LAY MARK
REG. U.S. PAT. OFF.
PREFORMED WIRE ROPE



Here is a wire rope that does not wear itself out internally. Wires and strands are preformed—shaped to the exact helical form they assume in the finished structure. Users report much greater service with Tru-Lay. Let us give you the facts. Address:

American Cable Company, Inc.
New York Central Building, 230 Park Ave., New York, N. Y.

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ON THE LEVEE

SINCE "Caterpillar" Tractors first went on the Mississippi Levee in 1921, each year has seen a steady increase in the number of them engaged on this stupendous task. Today, as "Caterpillar" Tractors are constantly added to levee fleets, their arrival excites no comment—it's accepted as the natural thing. Experiments with other equipment—tests of price versus quality—arouse curiosity, comment, passing interest. "Caterpillar" continues as the accepted standard.*

* September deliveries on the Mississippi Levee put the total number of "Caterpillar" Tractors engaged on that job well over the 500 mark—a complete survey showed a total at that time of less than one-fourth that many tractors of all other makes combined.

CATERPILLAR

REG. U. S. PAT. OFF.

TRACTOR

Caterpillar Tractor Co., Peoria, Ill., U.S.A.

Track-type Tractors — Road Machinery — Combines

(There's a "Caterpillar" Dealer Near You)

Prices — f. o. b. Peoria, Illinois

FIFTEEN	$1100	THIRTY-FIVE	$2400
TWENTY	$1450	FIFTY	$3675
TWENTY-FIVE	$1900	SIXTY-FIVE	$3850
DIESEL	$6500		

For your convenience in writing to Caterpillar Tractor Co., you will find a card bound in this issue.

Shots From the Firing Line— *Continued*

River Notes

By W. W. WHORLEY

Memphis—October 4th—19,467,000 cubic yards.

A consolidated bid from **R. T. Clarke Co., Inc., Delta Construction Company, John W. Noble, and Morrissey Construction Company,** Natchez, Mississippi, was successful in securing 16 sections of levee totaling 7,914,000 cubic yards, the price ranging from 13.5c to 17.25c for a total of $1,144,121.

Walter H. Dennison & Son, of Cushman, Arkansas, took five sections of 2,336,000 cubic yards at 16.98c and 15.48c for a total of $386,362.

Dave Elkas, of Leota, Mississippi, secured four sections totaling 1,415,000 cubic yards on bids of 15c and 14c per yard for a total of $202,750.

Canal Construction Company, of Memphis, took 1,635,000 cubic yards at 14.9c for $243,615.

The combined bid by **Stevens Brothers and the Miller-Hutchinson Company,** New Orleans, was successful on 1,153,000 cubic yards which were bid at 18.9c and 19.4c for a total of $220,917.

C. C. Aderholdt, of Memphis, took 552,000 cubic yards at 15c and 16c per cubic yard for a total of $85,900.

Boone & Webster, Inc., of New Orleans, secured 444,000 cubic yards at 19.8c for $87,912.

L. A. Wilson & Co., Inc., of Ottowa, Illinois, were successful on 700,000 cubic yards with a bid of 19.95c for a total of $139,650.

A. Guthrie & Co., Inc., of St. Paul, secured 2,758,000 cubic yards at 15.5c for $427,490.

Vicksburg—October 7—6,102,000 cubic yards.

Lewis and Chambers Construction Company, of New Orleans, received 2,493,000 of levee work between Cemetary Mound to Shipland. The work is divided into three sections and these went at 11.8c, 12.1c and 13.1c per yard respectively.

Driver Construction Company, of Driver, Arkansas, took 1,586,000 yards in two adjacent sections for 12.07 cents.

Arundel Corporation, of Baltimore, bid 11.38 cents to get their 2,023,000 yards at Arcadia Point.

New Orleans—October 11th—13,260,000 cubic yards

Carl Erickson and **W. S. Hardwick,** of Vidalia, La., and Beardstown, Ill., took Kempe-Lake St. John levee at 3,585,000 cubic yards at 12c for $430,200 and then sublet the project to **Boyce and Igo,** of Baton Rouge.

Moore Construction Company, of Liberty, Mississippi, were successful bidders on Deer Park Emergency Loop consisting of 80,000 cubic yards which went at 15.5c for $12,400. Moore Construction Company also took the Geismar Levee project consisting of 40,000 cubic yards at 15.5c for $6,200.

C. I. Jones, of Baton Rouge, was awarded 2,075,000 cubic yards on the Batchelor-New Texas Levee at 11.64c with a total bid of $241,530.

Grasser Contracting Company, of New Orleans, secured both the Picayunevill-Waterloo Levee of 3,170,000 cubic yards and the Dicharry Levee of 620,000 cubic yards with a bid of 8c, making the contract total of $303,200.

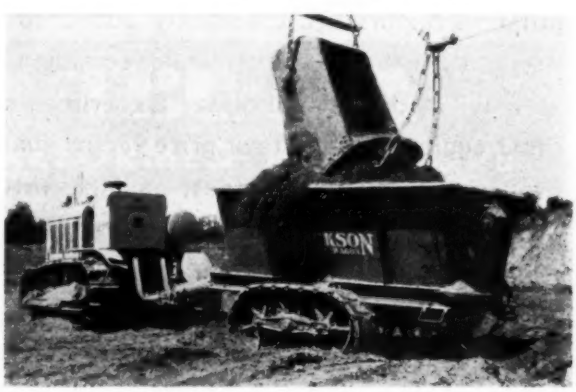
W. E. Callahan, of St. Louis, took 1,830,000 cubic yards in the Point Pleasant Levee and the Bayou Goula Bend Levee for 1,000,000 cubic yards at 8.6c for a total of $243,380.

Highways Construction Company, of New Orleans, were low on the 295,000 cubic yards of Tigerville Levee at 7.9c for $23,305; also the Sellers Levee of 145,000 cubic yards at 9.97c for $14,456 and the Ophelia Levee of 420,000 cubic yards at 11.47c, amount $48,174.

On the Upper Darrow Levee consisting of 95,000 cubic yards the **Lower Coast Construction Company,** of New Orleans, and the **New Construction Company,** of Sherburne, La., tied at 9.9c for a total of $9,405. The tie will be decided by lot.

In a bid at Memphis on October 11th, **H. J. Gilbertson Construction Company,** of Memphis, was low bidder on a new roadway from the Harahan Viaduct to the U. S. Engineer Supply and Repair Depot. Work includes placing 65,000 cubic yards of earth in roadway embankment, excavation of 2,800 yards for drainage ditch, paving roadway with 5,100 square yards of asphalt, together with other items. Bid price was $36,780.

The New Orleans District of U. S. Engineers, has started the dredging of approximately three million cubic yards in a cut-off for the Mississippi river across the Diamond Point peninsula. This work will shorten the main stream channel by 10 miles and lower peak water two or three feet at flood time. The dredge "Raymond" is working on the lower end and the dredge "Catt" will work from the upstream end. The project is expected to be completed in December.



From the **Forcum-James** job at Glen Allen, Mississippi, comes the above picture of a Caterpillar 65 hauling a Trackson wagon.

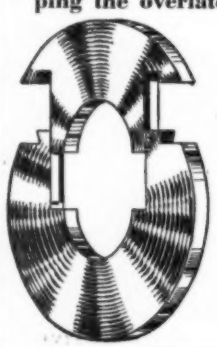
BIG SAVINGS

have small beginnings

THESE seemingly unimportant Quick Repair Washers may lead the way to a considerable saving of money both by keeping gears and pinions in mesh and thus saving wear and by eliminating shut-downs for extensive repairs.

The first repair may save you the cost of a year's supply of Quick Repair Washers.

No need to dismantle machinery. Quick Repair Washers can be put on quickly and easily. They are securely fastened by tapping the overlatch in place.



When ordering give inside and outside diameters and thickness of washers required.

BUCYRUS-ERIE COMPANY
Specialty Department
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BUCYRUS ERIE

For your convenience in writing to Bucyrus-Erie Company you will find a card bound in this issue.

In choosing candidates . . .
In buying wire rope . . .

let *Facts* be your GUIDE

Essentially there are only three points to keep in mind when buying wire rope: (a) Its suitability; (b) Its safety; (c) Its economy.

In this connection, consider these facts—

1. *Suitability:* The use of a Roebling Rope, recommended by this company, is positive assurance that your particular rope requirements will be *exactly* met. This is made possible by the great variety of types and designs of Roebling Rope, including Standard Right, Left, Lang, Preformed and Alternate Lays, in all degrees of rope and strand flexibility.

2. *Safety:* You can get no safer rope than Roebling. Safety is placed first in the making of Roebling Rope and is insured largely through painstaking production and testing methods, and by the use of Roebling Acid Steel Wire, custom-made in small open-hearth furnaces. In the steel industry it is acknowledged to be the finest rope wire made.

3. *Economy:* Performance records in endless number prove that Roebling Rope insures safe service at minimum cost. So convincing is this evidence that Roebling is able to assert that NO wire rope, regardless of make or construction, will show lower general-average operating cost.

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Wire • Wire Rope • Copper and Insulated Wires and Cables
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JOHN A. ROEBLING'S SONS COMPANY

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Shots From the Firing Line—*Continued*

St. Louis Notes

By A. J. KOENIG

The Missouri State Highway Commission received bids on Sept. 30th for grading and graveling **288 miles of state highway system** at an approximate cost of **$1,750,000.** There was no concrete slab construction involved in this letting. The specifications call for 146.4 miles of graded earth and 141.7 miles of gravel surface roads.

Another letting will be held on Oct. 28th for 84.7 miles of graded earth and 41 miles of gravel surfacing.

Successful bidders on the September 30th letting include: **W. A. Ross Construction Company,** Kansas City, 4.4 miles grading in Jackson County; **Davis Construction Company**, of Boonville, 4 miles gravel in Carter County; **Geo. W. Condon Company,** of Omaha, 1.5 miles of gravel in Franklin County; **M. E. Gillioz,** Monette, 12.8 miles of crushed stone in Barry County; **Kelly & Underwood,** of Granby, 18.1 miles of graveling in Cape Girardeau, Lacledge and Newton counties; **Jos. L. Pohl,** of Nevada, 2.3 miles of graveling in St. Clair County; **Otto W. Knutson,** of Kansas City, 7.7 miles of grading in Harrison County; **J. M. Roark,** of Anderson, 7.7 miles of grading in Jasper and Newton counties; **Martin Wunderlich,** of Jefferson City, 25.8 miles of gravel and grading in New Madrid, Cedar, Miller and Osage counties; **Lahar Construction Company,** of Boonville, 18.8 miles of grading in Butler, Cape Girardeau and Scott counties; **F. T. O'Dell,** of Hannibal, 13 miles of grading in Callaway County; **P. J. Murphy,** of Moberly, 5.7 miles of grading in Knox County; **Neyer Construction Company,** of Billings, Montana, 6.9 miles of grading in Lawrence County; **Samples & Elsea,** of Kirksville, 9 miles of grading in Lewis County; **H. D. Thomas,** of Fulton, 5.2 miles of grading in Moniteau County; **C. H. Atkinson Paving Company,** of Chillicothe, 3 miles of grading in Platte County; **Amos Melberg,** of Cedar Rapids, Iowa, 2.8 miles of grading in Scotland County; **R. E. Martin,** of Nashville, 7.9 miles of grading in Jefferson and Washington counties; **Vincennes Bridge Company,** of Vincennes, Indiana, a bridge in Jefferson-Washington counties; **Perry McGlone,** of Harrisonville, 18.7 miles of grading in Henry County; **Carte-Harlin Construction Company,** of West Plains, 14.9 miles of grading in Wright County; **State Highway Department,** of Jefferson City, 9 miles of grading in Dallas and Laclede counties.

Commissioner Willis J. Spaulding of Springfield, Ill., will ask for bids about Nov. 1st for two dams for impounding water **at the Lake Springfield reservoir.** Hecker-Moon Company was low bidder for the construction of two bridges at the lake, one of which will cross the lake. The contract has been awarded and work will start soon.

J. L. Simmons Co. was awarded contract for the construction of a bridge on Route 126 in Sangamon County, Ill.

Wm. F. Riley & Sons were low bidders for the construction of two brick sewers in West St. Louis.

Jackson county highway engineer awarded contract to **Boyle-Pryor Construction Co.,** 4.1 miles of concrete road, and to **Henderson Construction Co.,** for 4.8 miles of road in Jackson County.

S. J. Groves Co. was awarded contract for about 8 miles of highway in St. Clair County, Illinois.

It is with deep regret that we learn of the death of Hubert Hoeffken, superintendent of Hoeffken Bros. Construction Co., of Belleville, Ill. Mr. Hoeffken was killed in an automobile accident near California, Mo., while inspecting the 15-mile strip of concrete that had just been completed by the firm.

Contracts have been let during the past month for **dikes and revetment** work on the Missouri River for 40 projects approximating **$5,000,000.**

E. J. Eiff Co. were awarded contract for 15,000 sq. yds. concrete paving in Quincy, Ill. They also have contract for paving Highway No. 31 in Adams County, Illinois.

J. A. Tobin Construction Co. have contract for paving and grading in Wyandotte County, Kansas.

Fitzsimons & Connell Dredge & Dock Co. were awarded contract by the U. S. Engineers for excavating 243,000 cubic yards of earth in Calumet River at 19.4 cents per yard.

B. F. Brooks, Eldon, Mo., has a one-yard steam shovel, elevating grader, cats and dump wagons idle. **Looking for a job.**

Cole Construction Co., Bloomington, Ind., have a **¾-yard dragline idle.** Anyone that can use an outfit of this type for loading cat-wagons, trucks or for channel work can address them at 736 East Third St., Bloomington, Ind.

The Lay Construction Company of Centralia was awarded two contracts for grading earth, one for 4.395 miles on project 3-1 in Howard County, and the other for 4.694 miles on project 3-2 in Howard County.

Mike Haase of St. Joseph was awarded the contract for grading the earth on project SH-1 in Carroll County. This consisted of 3.307 miles.

Building a 40 Foot Fill

Raising this 40 foot fill on a railroad construction job, without the use of jacks—or the building of a trestle, is just one of the many instances where the Track Machine has been used at a great saving in time and labor. Disposing of overburden at quarries and mines, or any similar job where a track gang is maintained for shifting and raising, this machine and a few men will do the job quickly and soon pay for itself out of expense ordinarily required for men working with bars and jacks.

NORDBERG MFG. CO., Milwaukee, Wis.

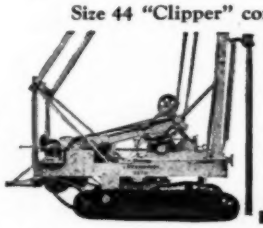
THE NORDBERG PATENTED **TRACK SHIFTER**

INCREASING FOOTAGE

by steadier drilling is the surest way to greater profits.

The speed of Loomis Full Length Crawler Mounted "Clipper" drills, in moving and getting set over the hole, gives more time for drilling and insures increased footage.

Size 44 "Clipper" comes equipped with steel frame; steel or wooden mast, wire or manila line.



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Established 1842

THE LOOMIS MACHINE CO.,

K STREET TIFFIN, OHIO

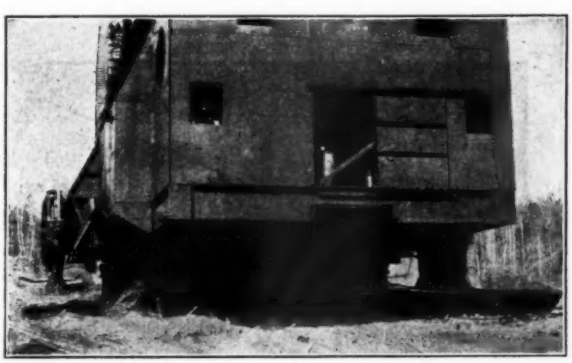
For your convenience in writing to the advertisers on this page you will find a card bound in this issue.

Though it rains in torrents tonight
—the Walker will work tomorrow!

WET, SOFT, yielding ground does not stop the Bucyrus-Monighan Walking Dragline. The bearing areas of its walking treads and of the separate circular base upon which it stands while digging, are unusually large. And when the treads do sink into exceptionally soft footing, the machine doesn't mire, but simply settles down onto its large circular base.

The treads then complete their cycle of operation and rise above the ground, and the operator can repoint the machine so that the walking treads will come down on fresh untrodden ground; or supporting materials can be placed under the treads when they are raised.

It is practically impossible for the Bucyrus-Monighan Walking Dragline to "dig itself in". Bucyrus-Monighan Company, Chicago, Ill.



BUCYRUS MONIGHAN

Walking Draglines 1 to 10 cubic yards

Sold by

BUCYRUS-ERIE COMPANY

South Milwaukee, Wis.

Representatives throughout the U. S. A. Branch Offices: Boston, New York, Philadelphia, Atlanta, Birmingham, Pittsburgh, Buffalo, Detroit, Chicago, St. Louis, Kansas City, Dallas, San Francisco. Offices or Distributors throughout the world.

B-24

For your convenience in writing to Bucyrus-Erie Company, you will find a card bound in this issue.

Shots From the Firing Line — *Continued*

Hyman Spitcaufsky, Kansas City, was awarded contracts for grading 4.993 miles on project SM-1 in Daviess County and also 4.997 miles in project SM-2 in Daviess County.

Martin Wunderlich was awarded two contracts for grading. One was for 3.718 miles on project SM-3 in Franklin County and the other 3.816 on project ST-1 in Franklin County. He was also awarded the contract for grading 4.869 miles on project SK-1 in Gasconade County.

M. E. Gillioz of Monett received the contract for grading 3.428 miles on project SH-5 in Greene County. He also received the contract for grading 3.593 miles on project SH-6 in Greene County.

Carte-Harlin Construction Company of West Plains was awarded the contracts for grading 2.944 miles on project SJ-1 in Howell County and 2.817 miles on project SJ-2 in the some county.

Martin Wunderlich also took contracts for grading 1.881 miles on project SA-1 in Jasper County; 3,900 miles on project SB-3 in the same county and 3.712 miles on project SB-4 in the same county.

Jewett & Hardy of Shelbina were awarded the contract for grading 1.998 miles on project SW-2 in Knox County.

Harry Tidd of Hutchinson, Kansas was awarded the contracts for grading 4.042 miles on project SC-3 in Linn County and also for grading 4.533 miles on project SC-4 in Linn County.

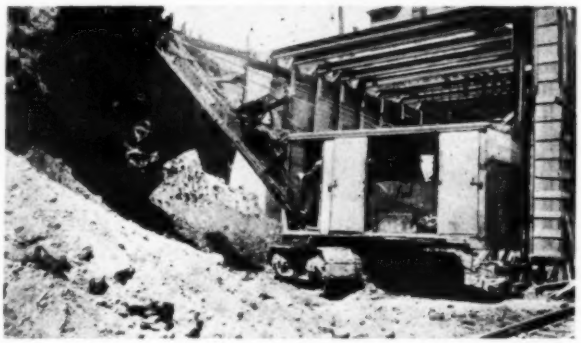
J. R. Brownfield of Ozark, Missouri was awarded the contract for grading 4.822 miles on project SC-1 in Stone County and also for grading 3.038 miles on project SC-2 in Stone County.

Ohio Notes

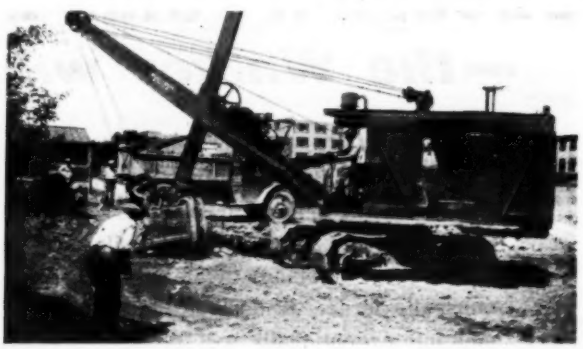
Successful bidders at the September 16th letting include the **Koski Construction Company** of Ashtabula with an $88,-100 project on Federal Aid Project E-11 in Ashtabula County; **W. L. Johnson Construction Company** of Hicksville, a $124,048 job of concrete paving on SR-78 in Monroe County; and **J. W. Bartels, Incorporated**, of Dayton with a $22,664 concrete paving job on U. S. 127 in Preble County. **Midwest Engineering Company** of Batavia was low on concrete paving No. 62 in Clermont County with a bid of $71,263.

Wisconsin Notes

By C. J. BACHMAN



Here is another one of **Richard E. Myers'** machines, also a Bucyrus-Erie Gas+Air, cutting into the bank south from West North Avenue in preparation for placing of a concrete retaining wall. Material is loaded to Western 12-yard dump cars and hauled north to W. Burleigh Street where fill is needed to carry the railroad tracks over the street. Operator Chas. F. Porter, who is handling this machine, comments that he has run them all from the old Atlantic railroad type shovels to big coal strippers but as far as he is concerned Bucyrus-Erie "can't be beat." "One day," he said, "the shovel worked straight through for 16 hours from 4 a. m. to 8 p. m. with the motor never stopping." Wm. Irons operates the second Gas+Air.



Wussow Brothers used their Bucyrus-Erie Gas+Air to grade for the Golden Guernsey Co-operative Dairy Company's garage on N. 30th Street as shown in the above picture. The material was loaded to Wussow Brothers' Mack "Bulldog" and Gunz & Switalski's Ford trucks. Operator J. Weink is up.

PARTNER. For the excavator who wants to cut down digging and handling costs, a Hayward Bucket is sure to prove itself a useful partner. Address The Hayward Company, 52-54 Church Street, New York, N.Y.
Hayward Buckets

"Anchor" Rerailers
Will retrack wheels from either or both sides of track at once
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The One-Man outfit for pulling, moving, lifting heavy loads
SAVES TIME & LABOR
NEW LOW PRICES
Complete Bulletin sent on request
"Anchor" Track Braces
For quick, lasting track repairs
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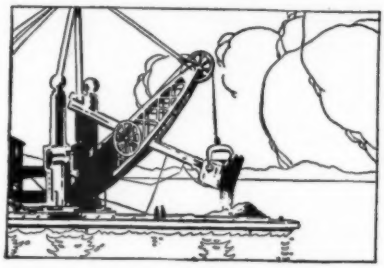

Dependable!

WHEN a wire rope fails unexpectedly or prematurely, there is always a loss of time and labor — for production stops but expenses continue.

And there is more to wire rope dependability than strength, altho strength is highly important. Toughness, elasticity, resistance to wear and resistance to fatigue are also vital.

"HERCULES" (*Red-Strand*) Wire Rope is dependable because it is made of acid open-hearth steel wire, and because every wire that is put into it is first rigidly tested by us to make sure that it meets our exacting standards, which have been established as the result of our many years of experience in wire rope making.

Another factor of great importance to wire rope users is that "HERCULES" is made in a wide range of constructions so as to be suitable for all conditions. If you will tell us how you use wire rope, we shall be glad to suggest the type we consider best for your work.

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A. Leschen & Sons Rope Co.

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For your convenience in writing to A. Leschen & Sons Rope Co., you will find a card bound in this issue.

Shots From the Firing Line — *Continued*

Illinois Notes

Berenze & Sons of Bloomington with their bid of $13,469 were awarded the contract for grading Route 80, Section 103VA, JoDaviess County.

C. A. Bettenhausen of Tinley Park with their bid of $35,452 were awarded the contract for grading Route 100, Section 123A in Pike County.

Texas Notes

By GEO. W. CARLSON

The above picture was taken recently on work of **Geo. W. Condon & Company** on Highway 40, Athens to Jacksonville, near LaRue, Texas. It shows a Bucyrus-Erie E-2 dragline with Atlas Imperial engine loading to Euclid dump wagons drawn by Allis-Chalmers tractors.

Since then the dragline has been moved to another State Highway job near Madisonville and later to Mississippi River levee work in Lousiana just below Lake Providence. This organization also has an identical outfit to the one shown, plus two elevating graders, working on Section 585-A, which involves 935,000 cubic yards. This job will be completed about the end of the year. They also have Section 598 amounting to 744,000 yards. This work directly across from Vicksburg has a contract time limit of 365 days as compared to the 150 day time limit on the first job.

New Mexico Notes

Armstrong & Armstrong of Roswell were awarded two Emergency Federal Aid Highway Projects on bids of $179,682 and $115,432.

Cook & Ransom of Santa Fe took a road mix at $37,601 and a road and machine mix at $96,248.

Bondurant & Bogle of Roswell also took one of the Emergency Fund projects on bid of $53,139 for concrete box culverts or $52,644 for corrugated metal culverts.

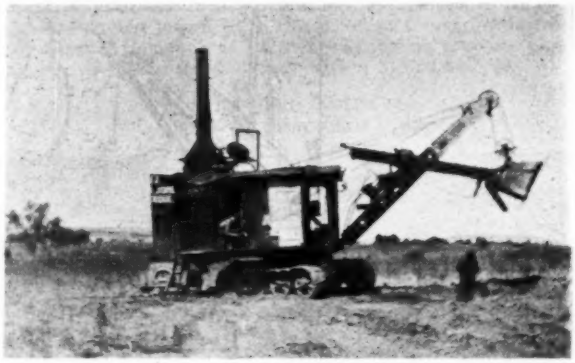
Colorado Notes

By H. M. BIBAUD

With the highway work in progress during the summer months at Wolf Creek Pass the greatest blast that has ever been set off in the San Juan Basin was one that, early in September, removed 15,000 cubic feet of solid rock from the right-of-way of the State Highway Department. Over three tons of dynamite were used in this blast, a 50-foot tunnel was driven into the solid rock, following which a 75-foot cross-cut was made, and both tunnels filled with dynamite.

A new Federal Aid Highway was designated for Colorado, August 29. The new road starts at a point on the Federal Aid Highway at Pagosa Springs, and extends to the Colorado-New Mexico line near Edith, Colorado. It will follow the route of the old Pagosa Spring-Chama, N. M., state road. With the addition of this road the Federal Aid mileage in Colorado is increased to 3,221.6.

Cooke and Stucker, contractors of Kansas City, recently constructed approximately 16 miles of road up Lightner Creek to the Texas Chief and Mountain Meadows mining properties in the La Plata mountains. The new road will make it possible for the owners of other groups of claims in the vicinity to open up their properties.



The Cedar Hill Aztec road that will unite with Highway 450 three miles south of Durango, leading to the Coast, is now under construction. The J. H. Miller Company of Pueblo holds the contract which involves $226,000, including the large bridge over the Animas river. The L. Leone Company of Pueblo is sub-contracting for the road building. Completion will result in the straightening of a very bad stretch of road, remarkable for a number of very dangerous curves and a perilous crossing at the river. The above Bucyrus-Erie steamer is shown moving in for the large amount of rock and earth removal. November 4 is the day set for the probable completion of the road building.

A preliminary survey to determine the best route to build a road to the Neglected Mine in the Durango mining section was started September 8th under supervision of James Deninson, Superintendent at the mine.

The Cortez road project that includes 7.718 miles of State Highway between Mancos and Cortez will be started as soon as the contract is signed by the state. Included in the contract are four bridges, one eighty feet long. The road will provide a second all-weather outlet to the south for southwestern Colorado through Cortez, Shiprock and Gallup. Specifications call for a grade 26 feet wide with a roadway of 24 feet. 120,000 yards of excavation, it is estimated, will be necessary. The project must be completed by June 30. Ivan Johnson, state engineer of Cortez will be in charge of the project. Wood, Morgan and Burnett were the successful bidders.

Four miles of highway west of Pagosa Springs was completed by the Steamboat Transfer and Storage Co. of Steamboat Springs about October 1.

Fair

Landlady: "You'll have to pay your bill or leave."

Lodger: "Thanks, awfully. My last landlady made me do both."

Cop (looking at man reposing in gutter)—"Drunk?"

Man (insulted)—"Certainly not; I'm just holding this parking space for a friend."

For your convenience in writing to George Haiss Mfg. Co. you will find a card bound in this issue.

Shots From the Firing Line — *Continued*

Nevada Notes

Jones and King of Hayward, California, were awarded the contract for reconstruction of that portion of the State Highway System in Washoe County, between Reno and Purdy, on their bid of $255,164.

Nevada Contracting Company of Fallon was awarded the contract for constructing a portion of the State Highway System in Clark County, between Glendale and Clark-Lincoln County Line on their bid of $112,606. They were also awarded the contract for constructing a portion of the State Highway System in Lincoln County, from Clark-Lincoln County Line and Maynard Lake, on their bid of $106,639. The contracts involve 437,000 yards of excavation. Owing to the conditions governing these contracts most of the work will be done by manual labor and scrapers instead of shovels.

The Nevada Rock and Sand Company, Incorporated, of Reno, with a bid of $16,576 were awarded the contract for constructing that portion of the State Highway in Lander County between 12 miles and 20 miles south of Battle Mountain.

A. D. Drumm, Jr,. of Fallon, Nevada, with a bid of $72,-129 was awarded the contract for reconstructing portion of the State Highway System in White Pine County, between West County Line and Pancake Summit.

Wheelwright Construction Company of Ely, Nevada were awarded contract for reconstructing that portion of the State Highway System in White Pine County, between Pancake Summit and West Foot Antelope Summit with their bid of $53,925.

Washington Notes

Lidral-Wiley Incorporated of Seattle were awarded the contract for grading and surfacing about 2.4 miles and surfacing about 3.7 miles of State Road No. 5, Suntop Trail to Park Boundary, Emergency Construction Highway Project No. E-184-E in Pierce County. The amount of the bid was $69,514.

Edlund, Pearson & Strom of Seattle with their bid of $47,530 were awarded the contract for grading 2.7 miles of State Road No. 10 Bridgeport North in Douglas County.

Contract for grading and surfacing 5.3 miles of State Road No. 21, Poulsbo South in Kitsap County, involving about 28 acres of clearing, 190,215 cubic yards of excavation, 23,080 cubic yards of crushed stone, 4,281 lineal feet of pipe culverts, 200 lineal feet of treated timber pile trestle and other items, was awarded to **Elliott & Company, Incorporated,** Seattle, for $94,586.

Contract for grading and surfacing about 7.8 miles of State Road No. 21, Poulsbo North in Kitsap County, involving about 56 acres of clearing, 225,225 cubic yards of excavation, 23,900 cubic yards of crushed stone, 4,114 lineal feet of pipe culverts and other items, was awarded to **Allen & Govan, Incorporated,** Olympia, for $102,136.

C. L. Creelman of Seattle, with his bid of $67,860, was awarded the contract for grading and surfacing about 5.4 miles of State Road No. 5 in Pierce County. He was also awarded the contract for grading and surfacing about 2.6 miles of State Road No. 5 in Pierce County with his bid of $77,382.

Colonial Building Company of Spokane was awarded the contract for grading about 2.7 miles of the Asotin-Oregon State Line Road in Asotin County, with their bid of $61,405.

The Hart Construction Company of Tacoma with a bid of $108,729 were awarded the contract for grading 5.6 miles State Road No. 5, Puyallup to Tacoma, Emergency Construction Highway Project No. E-185-A, in Pierce County, involving about 21 acres of clearing, 401,930 cubic yards of excavation, 973 lineal feet of pipe culverts and other items.

Tucker Brothers and Scott of Kalispell, Montana, with their bid of $37,970 were awarded the contract for grading and surfacing about 2.3 miles of State Road No. 3, Parvin Road to Colfax, Emergency Construction Highway Project No. E-152-C, in Whitman County involving about 46,220 cubic yards of excavation, 185 cubic yards of concrete, 6,150 cubic yards of crushed stone, 824 lineal feet of pipe culverts and other items.

Engineering Construction Company of Seattle on their bid of $14,929 was awarded grading, surfacing and construction of an overhead crossing on the C. M. St. P. & P. Railway Company on State Road No. 5. The work includes 11,000 cubic yards of excavation, 1500 cubic yards of surfacing, in addition to a timber pile trestle 225 feet long.

Strong & Macdonald, Incorporated, of Tacoma secured the contract for grading 4 miles of the Cascade Wagon Road, Marble Creek East in Skagit County, involving 258,770 cubic yards of excavation and other items on their bid of $156,127.

Oregon Notes

Lobster Mountain Section of Alsea-Deadwood Secondary State Highway No. 201, 0.75 mile of grading was awarded to **Yunker-Wiecks & Company** of Toledo, Washington, using concrete pipe on bid of $4,010.

Dennis Construction Company of Milwaukie was awarded the contract for grading 0.78 mile on the Jennings Lodge Section of the East Portland-Oregon City Highway with their bid of $11,507.

Aurora-Woodburn Section of the Pacific Highway, consisting of 5.08 miles of grade widening, was awarded to **Theo. Arenz** of Portland using concrete pipe on bid of $31,105.

San Francisco and Vicinity

By H. L. LIVINGSTON

Mittry Brothers Construction Company of Los Angeles is moving a Bucyrus-Erie 50-B Diesel shovel together with a Koehring shovel into their Santa Cruz job. This will be one of the largest highway jobs going on in California as some 900,000 cubic yards of material will be excavated in 8 miles of new highway. Under the new specifications of the California Highway Department this job calls for a five-day week of 30 hours for each employee on the job. The job will therefore be handled with two six-hour shifts per day.

Sharp & Fellows Construction Company of Los Angeles was low bidder to the U. S. Bureau of Public Roads for grading 17.3 miles of highway in the Maricopa-Ventura National Forest. This section is part of the Santa Barbara National Forest. The principal item of work is 1,040,000 yards of unclassified material.

Contract was awarded to **Thompson Brothers** of Fresno by the California Division of Highways for 8.4 miles of grading and surfacing between Lemon Cove and Three Rivers in Tulare County, California. The price for this job was $299,789 and involves 220,000 cubic yards of excavation. This work will be done with a Bucyrus-Erie Gas + Air shovel and a Marion 21 steam machine.

You don't know how economical
YELLOW STRAND
WIRE ROPE can really be until you try "Flex-Set" Preformed Yellow Strand on your excavating machinery. Made of tested, *selected* wire.
Get Catalog 51
BRODERICK & BASCOM ROPE CO.
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Factories: St. Louis and Seattle
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MEETING PLACE OF CAPITAL AND LABOR
THE KOENIG LABOR AGENCIES
Established 1875
ST. LOUIS
612 Walnut Street
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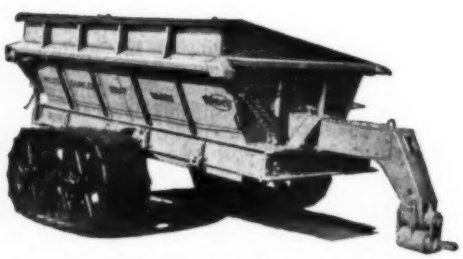
KANSAS CITY
501 Delaware Street
Main 0796
HELP OF ALL KINDS FURNISHED FREE

Western 7-8 yard Crawler wagons on Western crawler wheels working on J. E. Smith & Sons road contract near Ada, Okla.

Dependable Service Is Assured When Western Crawler Wagons are On the Job



The sturdy Western 7-8 yard wagon on Western Crawler wheels. This wagon can be equipped with a sloping top box as shown above for loading with elevating grader.

There is a satisfaction and peace of mind that you can have if Western Crawler wagons are on your job. Their rugged strength will carry them through the toughest job. You don't have to "baby" them. Just treat them right and they will do the same for you. You can depend on them, regardless of bad and changing hauling conditions. They will operate whenever and wherever your crawler tractor can operate.

There is a complete line of Western Crawler wagons in sizes that have been proved to be the most practical and economical. Only Western wagons are equipped with the Western spring windup for operating the doors. Only Western wagons are mounted on sturdy Western Crawler wheels. Send for Bulletin W-31-HK describing them all. It's yours for the asking.

Western Wheeled Scraper Company

Dump Cars and Grading Equipment

Aurora, Ill., U. S. A.

WESTERN

For your convenience in writing to Western Wheeled Scraper Company, you will find a card bound in this issue.

BOOK REVIEWS

Bulletin No. 1403 outlines the advantages of the use of the **Blaw-Knox Ateco Tamping Roller** from both an engineering and a contracting standpoint. Any reader interested in this equipment may obtain a copy of this bulletin by writing **Blaw-Knox Company, Blawnox, Pennsylvania.**

A 40-page catalog on the "Sixty-five" tractor has just been issued by **Caterpillar Tractor Company, Peoria, Illinois.** It is profusely illustrated and contains a complete description of this heavy duty model together with specifications and special equipment. Any reader interested may secure a copy on request.

Volume 2 of a series of booklets appearing under the general title **The Story of the Hoover Dam** illustrating and describing work at the Hoover Dam as it progresses has been issued by **Ingersoll-Rand Company, 11 Broadway, New York.**

Gas Electric Sets for Every Application is the title of an illustrated eight page catalog recently issued by the **Westinghouse Electric and Manufacturing Company, East Pittsburgh, Penna.** The publication describes and illustrates each set, listing its mechanical features, ignition, and control. Copies of the catalog, C. 1959, may be obtained by request to the Advertising Department.

Comparisons between the operation of a clamshell dredge for recovering gravel and a suction pump dredge for sand are given in Information Circular 6626, **Method and Cost of Dredging Sand and Gravel, Portland Gravel Company, Portland, Oregon,** by Howard F. Puariea. Details of dredge construction and operation are given, together with sketches of the equipment and tabulated operating costs. Both dredges described are of the self-contained type, each equipped to produce a washed and screened product from the dug material. This circular may be obtained free from the United States Bureau of Mines, Washington, D. C.

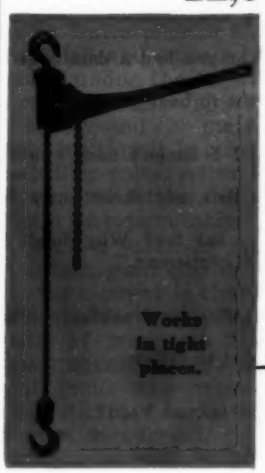
Electric Equipment for Mining Hoist is the title of a profusely illustrated 24-page catalog published by **General Electric Company, Schenectady, New York.** It embraces the practice and accomplishments of this company in mining hoists service in both the coal and metal mining fields. Any readers interested in receiving one of these bulletins should write General Electric Company at Schenectady or make inquiry at the nearest General Electric sales office.

Accelerating Swamp Fill Settlement with Explosives is the title of a new book published by the **Hercules Powder Company, Wilmington, Delaware.** It contains information and data on all known successful methods of fill settlement, and is profusely illustrated with diagrams and photographs. It will be distributed without cost to interested highway engineers.

A new, condensed catalog, entitled **Engineering Data, Industrial Rubber Goods,** giving a simplified, comprehensive line-up of principal industrial rubber goods, has just been issued by **The B. F. Goodrich Rubber Company, Akron, Ohio.** Among the condensed engineering data given are tables on rubber transmission belting, giving at a glance horsepower capacities, minimum pulley diameters, leather belt equivalents and list prices on all commonly used sizes; on conveyor belts, giving data never before published in this form for figuring the required sizes and plies; and on friction loss in rubber hose, hitherto unpublished, providing a practical means of estimating the pressure required to deliver a desired amount of liquid through hose of various diameters. A copy of this catalog will be sent upon request. Please mention **Excavating Engineer** when writing.

Shunk Mfg. Co., Bucyrus, Ohio, has issued road grader blades catalog No. 32-A containing specifications for over 3000 different types of grader blades or cutting edges, road drag blades, snow plow blades, rotary or fresno scraper blades, scarifier and rooter teeth, grader moldboards, etc. This manufacturer will be glad to mail copies upon request.

Easy Lifting— Handles up to 12,000 pounds



Handy Hoists take less time to get set for work (either hook may be fastened to the load), are light weight, and have no surplus chain to get snarled and kinked. A one man tool.

4 SIZES

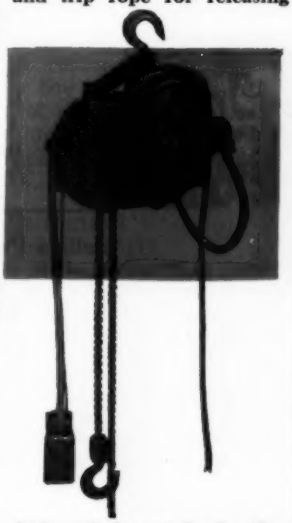
1,500 pound capacity
3,000 pound capacity
6,000 pound capacity
12,000 pound capacity

80-Pound, 2-Ton Electric Handy Hoist

A new Handy Hoist, electrically operated, is ready to solve your lifting problems. For use wherever 110-volt A.C. is available, it can be moved from one job to another by one man.

Four sizes for handling capacity loads of from ¼ to 2 tons.

Features of this new Handy Hoist include: automatic balancing hook, push button control, safety type limit switch, spur gear drive, positive automatic brake, outside adjustment for brake, oil bath lubrication, universal type motor coupling, special steel drop-forged swivel hook, special alloy chain (tested to 300% overload) and trip rope for releasing



chain without load. Also Hand Operated Handy Hoists for lifting from ¾ to 6 tons. Weights from 14 to 65 pounds.

BUCYRUS-ERIE COMPANY
Specialty Department *South Milwaukee, Wis.*

BUCYRUS ERIE

Please send complete information on

.....**Hand Operated Hoist.**
.....**Electric Hoist.**

Name .....
Firm Name .....
Address .....

MAIL THE COUPON NOW **MAIL THE COUPON NOW**

When writing to Bucyrus-Erie Company, please use coupon or card bound in this issue.

NOT IN THE CONTRACT

A Long, Long Trail

A drunk was passing along the tracks between Kansas City and Chicago when he stopped for a moment and called down to the man on a hand car: "Shay, whatcha doin'?"

"We're building a track for the Santa Fe," was the reply.

"How long is it goin' to take to build it?" promptly inquired the drunk.

"Five years," was the response.

"Five years! (hic) To 'ell with it. I'll walk."

Contractor: "Does the foreman know the trench has fallen in?"

Ditch Digger: "Well, sir, we are diggin' 'im out to tell 'im!"

"V'y is a pancake like der sun, Ike?"

Ike: "I dunno. V'y?"

"Because it rises in der yeast and sets behind der vest."

Mildred (the daughter of a dentist): "Well, dear, have you asked father for my hand yet?"

Bashful Suitor: "No. Every time I step in his office I lose courage. Today I allowed him to pull another tooth."

"It certainly was a wonderful party. Last thing I remember clearly was Johnson getting into the grandfather's clock and trying to telephone to his girl."

"Tell me, have any big men been born in this city?"

"Nope, only babies."

"Dorothy is getting married."

"Who is the lucky man?"

"Her father."

We, wife and I, were out driving the other day and passed a farmer-wagon drawn by a team of mules. The mules turned their heads towards us and bawled out a rather friendly greeting.

"I said to the wife: 'Relative of yours, no doubt.'"

She replied: "Yes, by marriage."

OUR office boy
CALLS his girl
APPENDIX because it
COSTS so much
TO take her out.

Polly's Preamble

"Aha," said the head clerk. "I'm glad to notice that you're arriving punctually now, Mr. Slocombe."

"Yes, sir. I've bought a parrot."

"A parrot? What on earth for? I told you to get an alarm clock."

"Yes, I did. But after a day or two I got used to it and it didn't wake me. So I got the parrot. And now when I go to bed I fix the alarm clock and put the parrot's cage on top of it. What that bird says when the alarm goes off would wake up anybody."

Judge: "What's the charge, officer?"

Officer: "He took an apple and two bananas from in front of a grocery store, your honor."

Judge: "Sixty days for impersonating an officer."

Peggy—"Harry was held up last night by two men."

Joyce—"Where?"

Peggy—"All the way home."

Husband (arriving home late): "Can't you guess where I've been?"

Wife: "I can; but go on with your story."

Joe: What caused the explosion on Cy's farm the other day?

Jack: He fed a hen some "Lay 'em or Bust" feed and the hen turned out to be a rooster.

Mother: "Mabel's young man has taken offense at something. Have you said anything to him?"

Father: "Not a word. I have not even seen him since I mailed him last month's electric light bill."

Traffic Cop to girl—"Where's the fire?"

Fair Speeder—"In your eyes, you great, big, gorgeous patrolman."

Foreman: "Do you think you are fit for really hard labor?"

Applicant: "Well, some of the best judges in the country have thought so."

"Do you always look under your bed before you say your prayers?"

"Oh, dear, no. I say my prayers first."

"I saw someone trying to kiss your daughter," said the mischief-maker.

Mother: "And did he succeed?"

Mischief-Maker: "No."

Mother:"Then it wasn't my daughter."

The woman who used to be ashamed of her past is now having it syndicated.

Friend: I want to tell you how much I enjoyed your lecture last night.

Speaker: Thanks, but I thought you had a date over at your girl's house.

Friend: I did—her parents went to hear you.

"Where's old Bill been lately? I haven't seen him for months."

"What? Haven't you 'eard? He's got three years for stealin' a car."

"What did he want to steal a car for? Why didn't he buy one an' not pay for it, like a gentleman."

Just Married: My wife likes coffee for breakfast while I like tea.

His Friend: You'll soon get used to coffee.

Rastus—Liza, will you go ridin' in mah Ford?

Liza—I won't do nothin' else.

Rastus—Then you can't ride in mah Ford.

"Have you any green lipsticks?" asked the flapper.

"Green lipsticks?" inquired the puzzled drug store cowboy.

"Yes—my new boy friend is a railroad man."

Andy: "My wife throws a fit everytime I come home late."

George: "Well, that's a lot softer than a skillet."

Characteristics of Shovel Motors

(Continued from page 529)

voltage. In weakening the field of the motor it is necessary to change the field current and where the field is designed for full exciter voltage the reactance of the winding is relatively high, but where the field is designed for reduced voltage, such as 70 volts it is necessary to insert resistance in series with the field to absorb the difference between 125 volts and 90 volts. The response of a change in current in resistance that has no inductance is instantaneous; therefore, a field circuit which is composed of a resistor which absorbs 35 volts and a field winding made up of resistance and reactance which absorbs 90 volts, will be faster than if there were no external resistance.

Wire Shaped for Compact Windings

Shunt field and commutating field windings are of square or rectangular wire, to utilize fully the available space for the coil. All field coils and leads are insulated with asbestos and thoroughly impregnated with insulating compound. In some designs the coils are wound directly on insulated steel boxes, shaped to fit over the back of the poles so as to be held rigidly between the pole and frame. This keeps the coil securely in place without the use of separate springs or washers which are a source of possible trouble.

Each motor has four main poles and two commutating poles fitted against machined seats in the frame and held by tap bolts passing through the frame. With this construction it is impossible for a bolt to work loose and drop against the armature. The frame split is above the horizontal center line and the two commutating poles are mounted horizontally. This construction permits any pole to be removed without moving the lower frame half from its foundation.

All main poles and commutating poles on certain motors are of laminated steel. The laminated construction permits the commutating pole flux to follow variations in the motor current with minimum lag and assists in maintaining good commutation under the rapid changes of load on shovel service. On general service motors where the load is steady and the machine is normally operated in one direction it is customary to provide solid commutating poles. After the motor is started up and its current settles down to some specific value, the flux in its commutating pole is fixed and presumably of such a value to give the proper correction to maintain good commutation; but on a shovel motor the current is changing almost constantly. For this reason there should be constantly changed value of magnetic flux to correct for armature cross magnitization and assist in reversing the current under the brushes. Unless this corrective magnetic flux is kept in constant step with the change in current, the benefit derived from the commutating pole windings may be of little value.

Maintenance Considerations Important

It is recognized that electric shovels are used in all parts of the country and quite often at points distant from sources of replacement parts. To meet this condition a motor design has been developed using roller bearings completely enclosed in housings at the two ends of the motor. In some motors this housing is arranged to take care of several makes of standard roller bearings which are suitable for shovel motor service. The housings are clamped between the frame halves, with a liberal area of clamping fit, but in certain motors this is not depended upon to prevent movement or possible loosening in the frame. At each side of the housing there is a recessed surface and clamps are bolted to the lower half, securing the housing in place independently of the fit between frame halves.

Ease of assembly and disassembly are provided in the design of the bearing housings. The housings may be removed with the armature with the lower frame half undisturbed on its mounting. By removing the housing cover the bearing is fully accessible and puller jaws can be placed at the back end of the inner race to remove the bearings without injury.

A positive and direct method of lubrication is employed, introducing lubricant at the outer end of the bearing and providing an escape port at the inner end for surplus or used lubricant. This port leads to a large reservoir at the bottom of the housing.

Bearing housings are designed for either grease or oil lubrication and may be provided with either Alemite or wick-feed fittings. Close mechanical clearances between the housing and shaft and effectively drained sealing grooves make the assembly tight and leak-proof.

The motors have massive cast seel frames, split horizontally and provided with hinges so that the top half can be readily swung back or lifted off. Hinges are removable. In some motors the wiring around the frame is arranged so that all lead entrances are below the frame split and no connection need be disturbed to swing back the top half. A large opening over the commutator is provided for inspection and adjustment of brushes. This is normally closed with an easily removable cover.

The frames have wide spreading feet, heavily enforced, cast integral with the lower half. Quite often it is necessary to crowd these motors into cramped locations where it may be difficult to reach the nuts on the holding down foot bolts. To avoid this difficulty the frames as constructed by some manufacturers have been recessed so that these nuts can be reached from the top of the motor by means of a straight socket wrench. This is often found of considerable value in mounting the motors on the shovel and facilitates their removal in the field in case of repairs.

New Equipment

(Continued from page 527)

area, ease of operation, and unobstructed view for operator.

The large, positive-acting plate steering clutches, a new crawler-tractor feature are in the rear compartment of the main frame. The steering brakes are immediately to the rear of the clutches. Efficiency of operation is enhanced by the use of forty-four ball bearings. The six-cylinder engine is of valve-in-head design and has removable cylinders of 3⅝-inch bore and 4½-inch stroke. A saddle-type-mounted heavy transverse spring carries the front of the tractor. Independent angle braces keep the tracks in true alignment and also permit free oscillation of each track to conform to ground conditions. An oil bath surrounds each track roller and the front idler shaft. Complete information will gladly be sent upon request. Please mention *Excavating Engineer* when writing.

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Address all box numbers c/o The Excavating Engineer at South Milwaukee, Wisconsin

SHOVEL OPERATOR

Have 22 years' experience on general excavating and grading projects on gasoline, electric or steam powered machines. Can give best of references and can do own repair work. Will go anywhere. Present location Louisiana. Box 3605.

CLAMSHELL-CRANE-SHOVEL OPERATOR

Experienced on Gas+Air and steam machines on general construction work. Willing to operate anywhere in U.S.A. Married. Can handle own repairing. A-1 references furnished. Present location North Carolina. Box 3602.

MINING ENGINEER

Mining Engineer, 34, married, fluent Spanish, desires position with responsible company. Experience — two years assistant engineer gold mine; three years foreman in large underground copper mine; six years foreman to mine superintendent open pit operating 25 electric shovels and draglines. Available immediately. Location, Maryland. Box 3801

CONSTRUCTION AND MAINTENANCE ENGINEER

Over 25 years' experience on all types of shovel, cranes, locomotives on general construction work. Capable of taking full charge of crew. At present located in Australia. Available for work in New Zealand, China or Federated Malay States. Can furnish excellent recommendations. Address replies to W. J. A., 22 Ruthven Street, Waverly, N. S. Wales, Australia.

DRAGLINE-CRANE-SHOVEL OPERATOR

Over 15 years' experience on gasoline and Diesel machines, large and small in quarries; on steel work; gravel pits and highway work. Willing to go anywhere on any size machine. Can do own repair work and can furnish excellent references. Married. Present location Illinois. Box 3601.

DRAGLINE—CLAMSHELL—SHOVEL OPERATOR

Have operated gasoline, electric and steam machines for past 15 years. Willing to go anywhere. Married. 36 years old. Best of references. Can do own repairing. Present location Minnesota. Box 3901.

SHOVEL OPERATOR

15 years' experience on electric, Gas+Air and steam machines on basement excavating; highway and railroad grading. Will go anywhere in U.S.A. Married. Age 35. A-1 references. Can do own repairing. Present location Pennsylvania. Box 3604.

DRAGLINE-CLAMSHELL-SHOVEL OPERATOR

18 years' all around experience on highway, drainage and mine work. Will go anywhere. Can do own repair work. Reliable references. Present location, Florida. Box 3802

SHOVEL OPERATOR

Have 14 years' experience on Gas+Air, straight gas and steam shovels. Willing to go anywhere in U.S.A. Married. Best of references. Can do own repair work. Present location, Minnesota. Box 3902.

DRAGLINE-CRANE-SHOVEL OPERATOR

Have had 15 years' experience on Diesel, electric and steam machines on levee and stripping operations. Will go anywhere. Married. A-1 references furnished. Can handle own repair work. Present location, Illinois. Box 3803

FOREMAN—ESTIMATOR—ENGINEER

15 years experience construction field as above. Age 34, married, war veteran, not afraid of hard work. Graduate University of Wisconsin College of Engineering. Will go anywhere. Excellent references. Available September 1st. Location, Illinois. Box 3703.

TRANSITMAN — OFFICE WORK

Experienced transitman with mining experience desires transit work, or will work as rodman, chainman or engineer's helper. Have also had experience as timekeeper, and much experience in safety work. Good references. Located Wisconsin, will go anywhere. Box 3513.

SHOVEL OPERATOR

Fully experienced on general types of excavating. Have operated Erie, Osgood, Lorain and Northwest gasoline and steam machines. Willing to work one month without pay as demonstration. If employer is satisfied he may pay me. Have full set of own tools and can do own repair work. Willing to go anywhere. Can come on twenty-four hours notice. Single. Reliable references furnished. Present location, West Virginia. Box 3702.

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OSGOOD GASOLINE ONE-CUBIC-YARD COMBINATION SHOVEL-CLAMSHELL-DRAGLINE. Six cylinder Beaver motor. Overhauled late 1931. Bargain price. Box 323-SS.

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DRAGLINE FAIRLEADS with or without boom and bucket. For Osgood gasoline machine.

FOR SALE

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30-B Bucyrus steam shovel. Located Charleston, Mississippi. Price $1500. Box 303-SS.

MARION STEAM SHOVEL, MODEL No. 21, high lift boom, and forward drum, boiler just retubed, location near Baltimore, in excellent condition. Price $3,800.00. Address Box 267-SS.

ONE 18-B BUCYRUS-ERIE, ⅞-yard dipper on full revolving caterpillars. Box 182-SS.

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MARION MODEL 21 AC-DC electric shovel. Shop number about 5500. 20-foot boom, 15-foot dipper handle, ¾-cubic-yard dipper. Suitable to operate on power-supply 3-phase 60-cycle 220 or 440 volt. First class condition. Box 208-SS.

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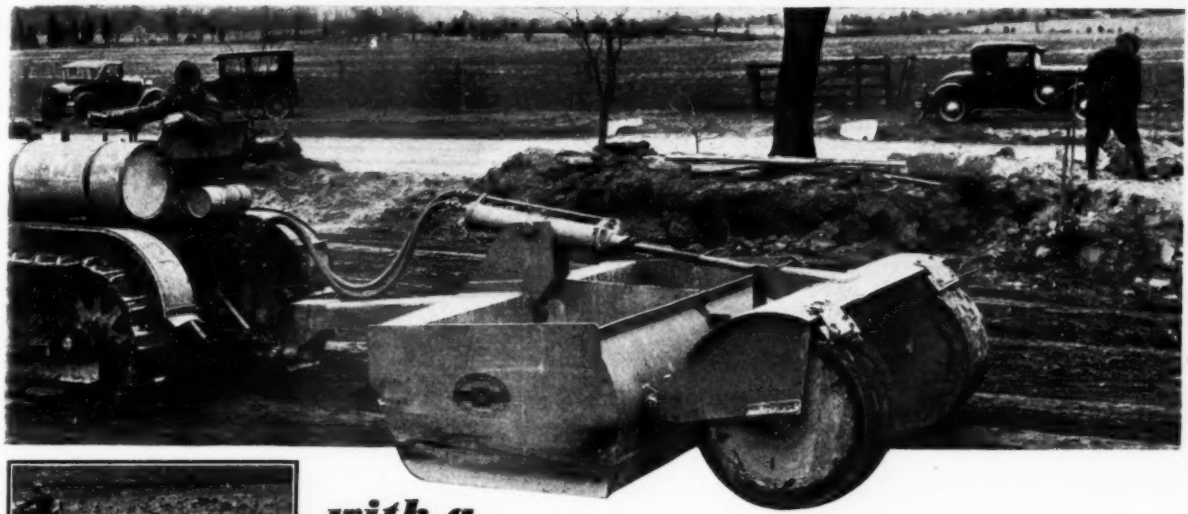

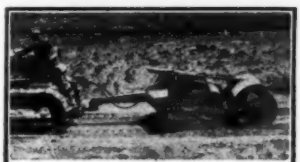

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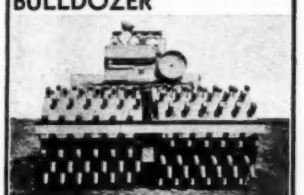

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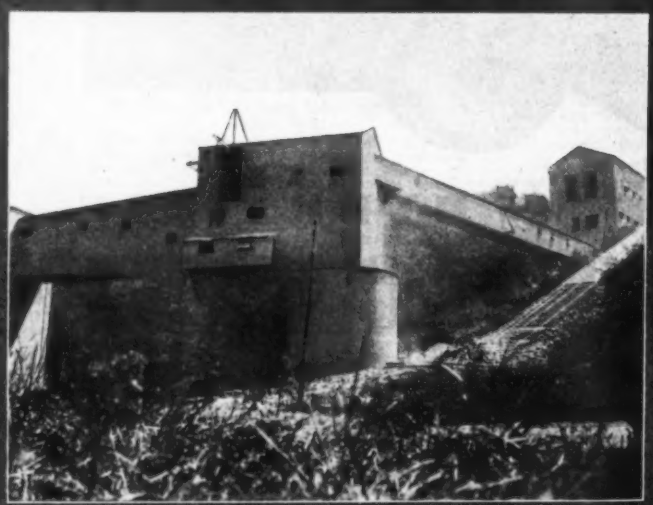

● *All ready to dump into the hopper of the primary jaw crusher. The dual left rear tires on the truck are about the last two left (as they catch rocks between them), and 16-inch width singles are now standard for rear wheels.* ● *A fair load of hard rock at Haverstraw quarry. J. Avery, at the controls of a 100-B Bucyrus-Erie, says it's a cinch to operate.* ● *The inclined railway is at the right. Two revolving screens and two 4-foot Symons crushers are located above the cylindrical silos. The building at the upper right contains sets of screens and two No. 10 McCully crushers. Another set of screens is located above the rectangular concrete bin at the extreme left. Under the silos and the bin, there is a conveyor belt in a tunnel. This belt carries the rock down hill to the left, under a highway and over a railroad, to the sizing screens and main storage silos.* ● *L. F. Miller (left) and Greer Tomlins, respectively Electrical Engineer of the New York Trap Rock Corporation and Superintendent of the Haverstraw quarry and plant.* ● *The quarry face at the Haverstraw quarry of the New York Trap Rock Corporation. Average height of this portion is about 145 feet.* ● *Looking down the hill from the primary crusher house. The belt conveyor in nearest conveyor housing takes rock from the two No. 20 McCully gyratory crushers to the screens and the two No. 10 McCullys; thence the rock rides on another belt conveyor to the two 4-foot Symons crushers. The building at the lowest end contains two revolving screens supplying the rectangular bin with minus 2½-inch stone.*